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THE TIBER AND ITS  
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*PLACE:*

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1877




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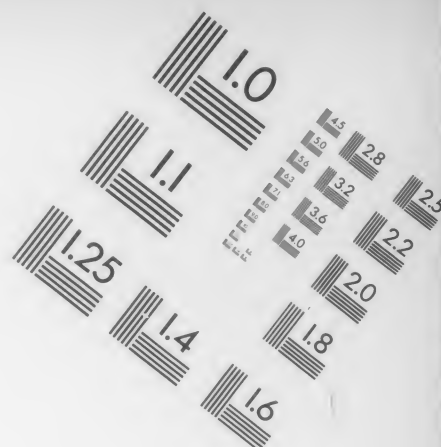
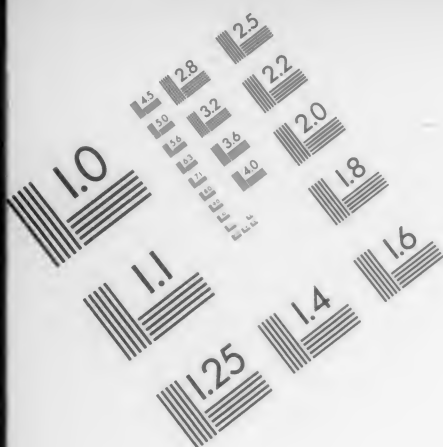


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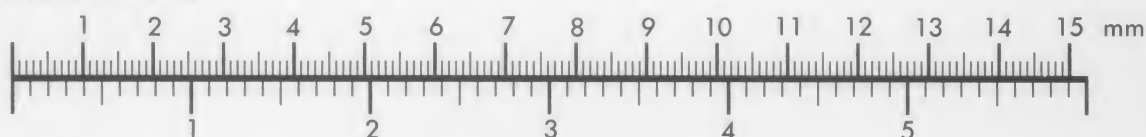
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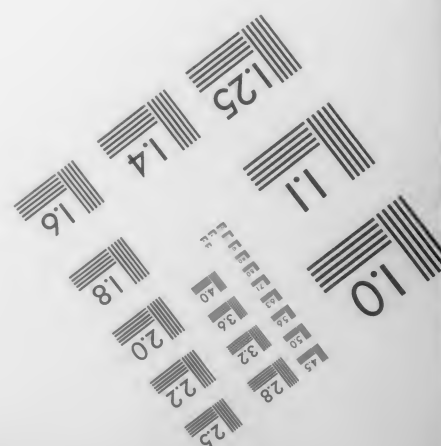
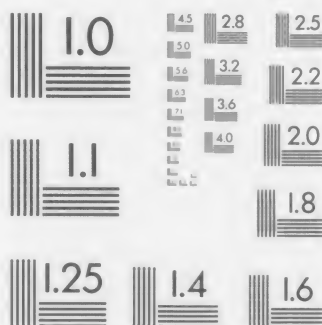
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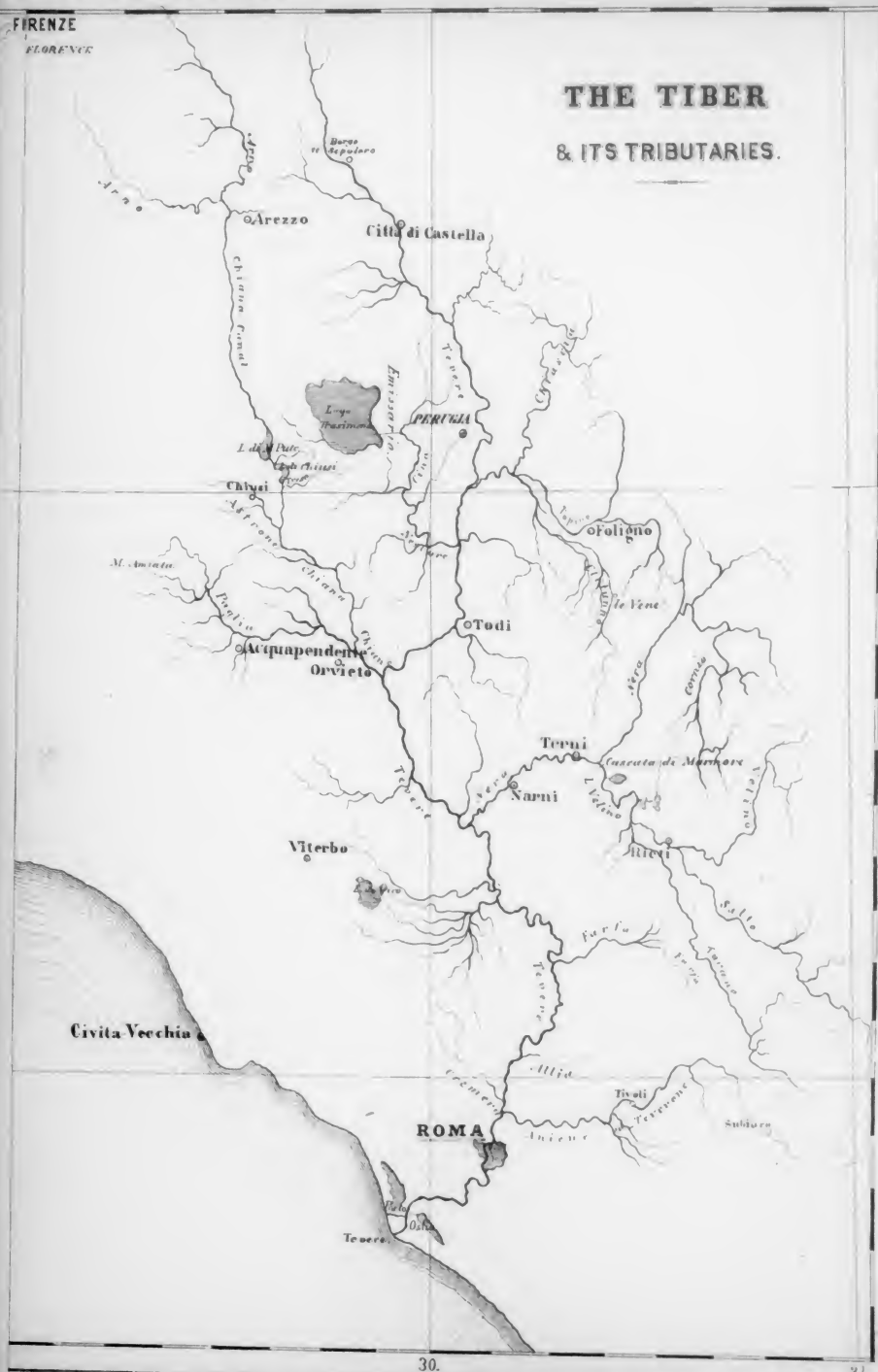
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THE TIBER  
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# THE TIBER & ITS TRIBUTARIES.



# THE TIBER

AND ITS

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(THEIR NATURAL HISTORY AND CLASSICAL ASSOCIATIONS.)

BY

STROTHER A. SMITH M.A.,

FELLOW OF ST. CATHARINE'S COLLEGE, CAMBRIDGE.)

(WITH MAP AND ILLUSTRATIONS.)

London:

LONGMANS, GREEN, AND CO.,

1877.

PREFACE.

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31 THE object of this work is to gather under one head everything of interest relating to the Tiber. For this purpose I have collected the facts which are scattered through a variety of works, some of which are out of print, and are fast mouldering away in the few libraries where they are preserved. In the latter alone are to be found the details of the great inundations of the sixteenth century, those of 1530, 1557, and 1598, an acquaintance with which, as well as with the meteorological conditions which preceded them, is essential to one who would explain their causes, foresee their recurrence, or devise the means of limiting their effects; for the idea of preventing them altogether I believe to be chimerical.

1746.85 As the Tiber never obtains more than a passing notice in the volumes which treat of the antiquities and churches of Rome, I have been led to consider that its history and associations are worthy of a more complete description. The subject, indeed, is usually assumed to be devoid of interest; but as the uninformed and unimagative may travel from Dan to Beersheba, and exclaim that all is barren, while a  
b

shrewder observer may notice facts which throw light upon history and science, or afford food for thought to the reflecting, so, notwithstanding the indifference with which the Tiber is regarded in general, it is hoped that some amusement and instruction may be gathered by the inquiring from its natural history and associations.

A few years ago an interest was awaked about the Tiber, in consequence of a project lately revived, and which seemed likely to be seriously carried out, of dredging its bed, in order to recover the works of art supposed to have been cast into it in times of insecurity. But it was only as a receptacle for these works of art that any interest was felt about it. Most persons would be content to see it dried up for ever, or diverted altogether from the city, as was suggested in the time of Sixtus V., if they could reach with greater ease the objects which they prize.

I have been unable to discover any authority for the story of "Ecce Tiberim," though I had hoped to find it before this work was printed. I should be obliged, therefore, to any of my readers who would enlighten me on this point. The anecdote has been familiar to me as far back as I can recollect; yet, strange to say, I have never met with an Englishman who had heard of it before. The story, however, is well known to the Scotch, who, being as intensely national as the Romans themselves, appear to have been offended by the comparison of the Tiber to the Tay, and to have resented as an insult what was

intended as a compliment. In the "Fair Maid of Perth" there are four verses alluding to this story which form the motto of one of the chapters; but, as they are not very complimentary to the Tiber, I refrain from quoting them. To those, however, who know the verses, or have the curiosity to search for them, I may observe, that the comparison is not a fair one, as the Tay at Perth is an estuary, and, therefore, widened by the tide, while there is no tide in the Tiber. The estuary of the Mersey at Liverpool is much wider than any part of the Rhine from Basle to the sea; yet it would be absurd to speak of the Rhine as puny compared with the Mersey, whose course is short, and whose width is insignificant above the influence of the tide.

The authors of most of the books upon Rome appear to consider the works of God as unworthy of mention by the side of those of the great painters and sculptors of Italy. An object in Nature obtains but a cursory notice, while the vulgar errors, with regard to Natural phenomena and their causes, current among the ignorant and superstitious Italians, are adopted without hesitation, and given to the world as if they were undoubted truths. In order, therefore, to supplement these works, I have chosen a subject more suggestive than any other of scientific topics, and, at the same time, associated with many eminent persons and remarkable historical events; and I have collected everything connected with it which I thought would interest at once the classical scholar and the lover of Nature. A river, also, has the advantage of being more unchangeable than any of



those objects to which Roman artists and archæologists confine their attention. A time must come when the Coliseum, by repeated restorations, will be like a knife with a new handle and a new blade, nothing remaining but the form or model of the original building and the memories which will still cling to it. But the Tiber, like other rivers, whatever minor changes it may have undergone since the last geological convulsion, is essentially the same that it was when the Palatine hill was first occupied by the Arcadian adventurer:

*Labitur et labetur in omne volubilis ævum.*

## INTRODUCTION.

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It has long been a matter of surprise to me that while so much has been written on the ruins and monuments of Rome, while every fragment of a brick wall has been made the subject of a learned treatise, and its plan and purpose illustrated by diagrams and photographs, the Tiber, the river in which the Romans took such pride, has been passed over in silence or mentioned only in disparaging terms. The author of a late work on Rome and the Campagna remarks in substance that the Tiber is large enough to be mischievous but too small to be useful. The observations of others are nearly in the same strain; Eustace and the late Lord Broughton (Sir J. Cam Hobhouse) being, as far as I know, the only two writers who have attempted to defend the river against its detractors. Yet the feelings and superstitions of the Romans with regard to the Tiber belong to what may be called the Archæology of the Roman mind, and the river may be regarded as a ruin in a certain

sense. As a man is said to be ruined who has lost his fortune, and with it his social position, though he remains physically the same being as before; so the Tiber, which has fallen from its high estate under the Romans, which has lost its crown of palaces and groves, may be styled a ruin of what it once was, though it has merely reverted to its former state, when it flowed through primeval solitudes. I will try, therefore, to do for the Roman river, according to my imperfect ability and knowledge, what Canina has done so well for the other ruins of the city, and as the antiquarian has restored on paper the Roman Forum and the Appian way, to restore in imagination a faint image of what the Tiber must once have been, and what, I trust, it will again become.

To many, doubtless, it will seem absurd to write a book upon it. For how, it may be asked, can a single river furnish materials for even the thinnest pamphlet? To such a question I would reply, that not only is no river in the world so rich in associations as the Tiber, but that the river, with its tributaries, presents an epitome of the physical peculiarities which are to be found in all the other rivers of the earth. If Byron has used the bold figure "stumbling o'er recollections,"\* I may be allowed to speak of the Tiber as laden with associations, as bearing with it to the heart of Rome

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\* "Childe Harold,"—Canto iv. 81.

whatever of historic or poetic interest it has gathered along with their waters from its tributary streams, the Clitumnus, the Velinus, the Anio, and the Nar. Such were the thoughts which crowded on the mind of Goethe's "Werter," when he gazed upon a stream which had traversed some country far away, perhaps, but renowned in history, romance, or song; and though I cannot enter into all the feelings of that sentimental being, I fully sympathise with this.

To me there is something more grand, as well as more suggestive in a broad and rapid river than in the ocean itself. When Columbus beheld the vast volume of water discharged by the Orinoco, driving back for many a league the waves of the sea, and freshening its waters for a hundred miles, there arose before his mind the image of a mighty continent, with all its attendant features, boundless plains traversed by the river in its lower course, trackless forests overshadowing its stream, and tens of hundreds of miles away, ranges of lofty mountains, whose summits were lost in the clouds, and whose rains and snows fed the sea of waters which rolled tumultuously past his ship. He felt that the great object of his mission was accomplished, that his success was complete, and that not merely Hispaniola and Cuba, large as those islands are, but a fourth quarter had been added to the habitable globe. But in the monotonous ocean, the symbol of unchangeableness, there is nothing to aid the

imagination in its flight beyond the visible horizon; nothing to indicate whether we are looking on the straits of Dover or upon twenty miles of the broad Atlantic.

The Tiber would be but a third or fourth rate tributary of the Orinoco. But if it does not speak to the imagination by its vastness, there is the element of the grand in its inundations, and it is interesting from its associations and its natural history; for its lakes, morasses, cascades, and plateaus illustrate on a small scale the physical geography of other rivers, or are illustrated by it; while "anastomosis," or the connection of two water systems by the intervention of a third, a phenomenon of rare occurrence, but seen on a grand scale in South America, is observed in miniature proportions in the case of one of its tributaries, the Chiana.

There are enquiries, likewise, suggested by the physical peculiarities of the Tiber and by its inundations, which may be pursued with advantage, as throwing light upon archæological or scientific questions; the extent, for instance, to which sun-dried bricks were used by the Romans, and the degree of rapidity with which the plains, and with them the beds of the rivers which traverse them, are raised by the annual deposit brought down by the streams.

Geography is a science of which most persons, even those otherwise well educated, are not entirely ignorant. They are satisfied, in general, if they are acquainted with the shortest and most convenient route by which

they may reach the place to which they are bound, or know whether a town which has been the scene of some great natural convulsion, or some important political movement, as in Belgium or in Spain. Of the natural features and characteristics of countries, called by the name of Physical Geography, they know nothing, and are not ashamed to confess their ignorance. It seems, even, as if many persons had a contempt for Geography, in common with the other sciences of observation, such as Botany and Natural History, as though it required no exertion of the intellectual powers.

But, whatever the reason, Geography is a science which ought to become an essential part of a liberal education. Of the Tiber above Rome as little is known as of the river on which Yarkand is situated. I have known persons long resident in Rome who fancied that the Nera, the principal tributary of the Tiber, flowed into the Adriatic, making its way by some unknown chasm through the great chain of the Apennines, and that the Tiber was a smaller river than the Arno, though the former is more than one-third longer than the latter, and contains at least ten times its volume of water. For the single affluent the Anio, which makes no apparent addition to the bulk of the Tiber, discharges into it more water in summer than the Arno can collect in the whole of its course.

Mr. Burn, in his work on Rome and the Campagna, which is, doubtless, extremely correct in all that relates to the monuments of antiquity and the works of man,

appears to be completely in the dark about the Tiber between Rome and its source. He calls the Chiana its principal tributary, probably because he has more frequently seen the name of the Chiana than that of the Nera, and attributes its inundations to its short and tortuous course; though what connexion there is between the short and winding course of a river and its floods it is difficult to discover. One might as well account for the riotous excesses of an individual by the shortness of his stature and the crookedness of his shape. Short, moreover, is nothing but a relative term. The Tiber is short indeed, compared with the Mississippi or the Amazon, being about one-fourteenth part of their length; but it seems absurd for an Englishman to talk of the shortness of a river which, even above Rome, exceeds in length the Thames from its source to Gravesend.

Mr. Burn and others would say, perhaps, that it was no part of their plan to describe the Tiber, and that the river itself is so insignificant that they may be excused for knowing nothing about it. But, as a man would rather have his existence ignored than be described, from imagination or imperfect information, as only five feet high and distorted in shape, so father Tiber protests against his name being mentioned at all, if it is only to be mentioned in disparaging terms, by those who will not give themselves the trouble of obtaining correct information regarding him. He recalls with indignation the following passage in the diary of a lady traveller: "At the Ponte-Molle we crossed the

Tiber, a small stream."\* He thinks the lady must have been dozing when she crossed the bridge, knowing, as he does, and as every person who pretends to describe him ought to know, that the river at the point in question is four hundred feet wide, when lowest, and discharges through the six arches of the bridge more fresh water than the Thames and Severn combined.

The commissioners appointed by the Government to consider the best means of preventing or lessening the inundations of the Tiber have just given in their report. They recommend the deepening and widening of the river at certain points, and the removal of the mills, piers of ruined bridges, and other obstructions to the flow of the water; among the rest the picturesque ruin called the Ponte Rotto. By this means they expect to lower the level of the river in time of floods no less than two metres. In this expectation they will, I believe, be disappointed. The removal of these obstructions will facilitate the navigation of the Tiber; but, instead of lowering the level of the floods two metres, it will not, I am persuaded, make the difference of two inches. This I will undertake to shew in its proper place.

Without a knowledge of the physical geography of the Tiber above Rome and of its meteorological conditions, it is impossible to say what quantity of water may, under a combination of circumstances, be

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\* Quoted by the late Lord Broughton, then Sir John Cam Hobhouse, in his work on Italy.

poured into the valley of the river. Yet neither of these points appears to have been taken into consideration by the commissioners. But, surely, it is necessary to estimate the quantity of water which has to be discharged by a pipe, before we can say that the pipe, however free from obstructions, is able to convey it.

The works which I have consulted, besides the classical authors, are:

1. "Del' Tevere" of M. Andrea Bacci, published in 1576, and containing a full account of the Inundation of 1557.
2. "Il Tevere Incatenato" of the Abbate Filippo Maria Bonini, Vicario Generale of Palestrina, published in 1663.
3. "Il Tevere Navigabile" of Leone Pascoli, published in 1740.
4. "The Report of the Engineers, Andrea Chiesa and Bernardo Gambarini," who were appointed by Clement XII. to enquire whether there were any means of rendering the Tiber navigable from Ponte Nuovo, six miles below Perugia, to the confluence of the Nera. The Report, which was drawn up after the death of Clement, and dedicated to his successor, Benedict XIV., bears the date 1746.
5. A Work on the Anio and the Inundation of 1826, by an Inhabitant of Tivoli and an Official of the Government. The name of the author I unfortunately forgot to note before I quitted Rome, and the book cannot be found.
6. The elaborate Work of Elisée Reclus, entitled "La Terre," which contains a large mass of information gathered from various sources.
7. "Etudes Sur Les Inondations," par M. F. Vallès, Ingénieur en Chef des Ponts et Chaussées. A Work which treats the subject of Inundations in great detail, and exposes many popular fallacies.

8. Muratori, "Annali d' Italia."
9. Moroni, "Dizionario d' Erudizione Ecclesiastica."
10. Letters of the Correspondent of the "Times" relating to the Embankment of Rivers.

I have also derived some useful hints from a pamphlet by Signore Lanciani on the port of Trajan, and from another published a short time ago by Signore Aubert on the late inundation and the means of preventing similar calamities. Something, also, has been gleaned from Preller's "Rom und der Tiber." Most of the modern writers, however, and Preller among the rest, confine themselves to the Tiber in and below the city of Rome. They treat the river as if it had no antecedents, as if it descended from the clouds, or emerged from the earth immediately before it entered Rome. Their suggestions, therefore, are of little value, and the remedies which they propose are either entirely useless or mere palliatives, as I shall be prepared to shew more fully in the course of this work.

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Ponte quatro Cani

Ponte Sisto

Ponte rotto

ISOLA S<sup>T</sup> BARTOLOMEO ET PONTE ROTTO.





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## THE TIBER AND ITS TRIBUTARIES.

THE TIBER.

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THE transference of the capital of Italy to Rome, and the late disastrous inundation in 1870, have directed public attention to the river Tiber. Its destructive floods, and their causes, have formed the subject of conversation in every society, and various schemes have been suggested, by which the occurrence of similar visitations may be prevented, or their inconveniences confined within the narrowest possible limits. A navigable river is an advantage, which, in opposition to other considerations, has often determined the site of a town; but in the case of the Tiber there are peculiarities which have caused it to be viewed with disfavour by many, and even regarded as a nuisance, and an objection to Rome as the capital of Italy. The sudden and enormous rise of its waters, which within the historic period have attained the height of forty feet above its summer level, and the copious deposits of mud left by the receding flood, which disfigure its banks, and generate unwholesome vapours during the summer heats, are thought by many to outweigh its advantages as a navigable river, and even to leave a balance of mischief to its account.

Far different were the feelings with which the Tiber was regarded by the Romans in classical times. Rivers among the

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ancients were objects of religious veneration, and often of religious worship. The most important streams had their own peculiar deities, to whom sacrifices were offered, and whose rites were celebrated at stated periods. These deities were always represented with horns, and of a cœrulean or sea green hue.\* Thus Virgil calls the Tiber (VIII. 64 & 77) "corniger fluvius" and "cœruleus amnis,"† in reference to the colour of the god and not of the water. With other rivers poetic legends were associated, as with the Acis and many others, whose names are familiar even to those who have no acquaintance with classical lore. The Tiber, indeed, had no distinctive worship, though its principal tributaries possessed, as we learn from Tacitus, "their own peculiar rites, their altars and their groves;" but the river itself was regarded with a feeling of mingled reverence and affection, which appears incomprehensible to the moderns who gaze upon its muddy stream. If its appearance is so repulsive in the present day, what must it have been when it was the common sewer of millions of human beings.‡

\* Ovid thus describes the change of Acis into a river:

Miraque res! subito media tenus exitit alvo  
Incinctus juvenis flexis nova cornua cannis;  
Qui, nisi quod major, quod toto cœrulus ore est,  
Acis erat.—Met. XIII. 893.

† It is strange that Servius should have so far mistaken the meaning of "cœruleus" as to explain it by "deep." Most commentators maintain a discreet silence, evidently referring the word to the colour of the water, but not knowing how to reconcile it with the epithet "flavus" usually applied to the Tiber. Nibby fancies he discovers a faint shade of blue in the water after a spell of dry weather, when the river has deposited all its yellow mud, like milk, which has been well watered, called in London slang "sky-blue." But, surely, Virgil, who was familiar with the Mincio and the Adda, rivers which with propriety may be called "cœrule," would never have used the term as characteristic of the Tiber. Heyne, of course, sees the meaning of the word.

‡ Many historians have been puzzled to explain how the limited area within the walls of Aurelian—occupied, as great part of it was, by temples, baths, and other public buildings—could have contained the millions that are supposed to have been congregated within the city bounds. Sufficient account has not been taken of the suburbs, which extended to a prodigious distance from the walls. "Exspatiantia tecta," says Pliny the naturalist, III (section on the Tiber and Rome) "multas addidere urbes." "The continual extension of the buildings has added many cities to the original

We have no reason to suppose that the Romans under the Empire had any system of intercepting sewers, by which the filth of the city was diverted from the river, and employed in fertilizing the land. The stream, both within and below the town, must have been still more unsightly than it appears to us. Yet no where is the Tiber spoken of in disparaging terms. No Roman humorist would have attempted to provoke a smile at the expense of father Tiber; no Roman *Punch* would have represented him as crowned with a diadem of drowned animals, or other disgusting objects, to denote the impurity of his waters. Nay, so anxious were they to spare his feelings that, when it was proposed to moderate his inundations by diverting into new channels the streams and lakes by which his waters are swelled, it was looked upon as a crowning objection to the scheme, that "father Tiber would be unwilling to be bereft of his affluent streams, and to flow hereafter with diminished pride."\* His defects were glossed over, invested with a poetic interest, or described by terms expressive of qualities that are pleasing to the eye. His colour was euphemised by the word "flavus," which may be translated "auburn;" for Ganymede, who was stolen away by order of Jupiter on account of his beauty, is called by Horace "flavus Ganymedes"† "auburn-haired Ganymede," so that, whatever was the shade of colour denoted by "flavus," it must have been beautiful to Roman eyes. On the other hand, as far as I can recollect, no epithet expressive of impurity is ever applied to the Tiber. Its flow was described as majestic, and even its inundations were regarded with religious awe as manifestations of the anger of the river god. Thus Pliny the naturalist, in his strange and figurative style, observes that, even in the sudden risings to which the Tiber is subject, we may with more truth discern the seer, the monitor, and the awakener of religious awe, than the stern and pitiless

one."—These were the Kennington, Chelsea, Notting Hill, Islington, &c. of Roman times, and all their sewage must have drained into the Tiber.

\* Tac. Ann. I. 79.

† Hor. Car. IV. 4.

tyrant.\* Horace, also, in relating the effects of an inundation which destroyed the temple of Vesta, and led the nations, he says, to expect a return of the universal deluge, has no harsher term to apply to the author of so much mischief than "uxorius amnis," "uxorious river," or river overfond of his mythical wife Rhea Sylvia, whose cause he is assumed to be avenging.† In the earlier period of the republic the Romans were acquainted with no river with which they could compare their own; but even when they were familiar with the majestic streams of the Rhine and Danube, their partiality could suggest no grander standard of comparison than their native Tiber, and "Ecce Tiberim," "Behold the Tiber," was the exclamation of the Roman legions when they first caught sight of the Tay at Perth.

While Pliny describes the navigable capabilities of the Tiber, and personifies it as "Mercator placidissimus,"‡ a "most benignant merchant," who conveyed to Rome the productions of every clime, Virgil enlarges upon the beauty of the river in early days, when its banks were still in a state of nature, fringed with forests, and vocal only with the song of birds, and styles it "amœnus,"|| or "picturesque," and "cœlo gratissimus amnis,"§ "river most acceptable to heaven." Later writers are equally enthusiastic in its praise, when it bore a more artificial character, and owed its beauty to the hands of man. Pliny the elder observes: "that all the rivers in the world together were not peopled, or adorned with such a multitude of villas

\* Plin. III. 9.—Quinimo vates intelligitur potius et monitor, auctu semper religiosus verius quam saevus.

The same veneration for the Tiber appears to have existed among the Tuscan nations. For Livy relates that they deferred a war which they contemplated with the Romans, in consequence of an inundation of that river which laid waste the property of their leaders:

"Ni Viens bellum religio principum distulisset, quorum agros Tiberis super ripas effusus maxime ruinis villarum vastavit. IV. 49.

† Hor. Car. I. 2.

‡ Plin. III. (9), 54. Teub.

|| Huic Deus ipse loci fluvio Tiberinus amoeno. Vir. III. 31.

§ Cœruleus Tybris cœlo gratissimus amnis. Vir. VIII. 64.

as the single river Tiber."\*\* Dionysius, surnamed Periegetes, who lived about 300 years after Christ, and wrote a description of the world in Greek Hexameters, calls it "most regal of rivers;"† and Claudian, writing a century later, anticipates a time "when the Rhine shall be lined, after the fashion of the Tiber, with mansions pleasing to the eye."‡

The moderns, who know the Tiber only as a river winding through the desolate Campagna, or skirted by mean and dirty buildings in its passage through the town, may smile at the epithet of regal which the poet bestows upon it. But the word merely expresses the effect produced upon his imagination by the lordly mansions and richly-decorated villas, between which the Tiber flowed, suggesting to his thoughts the power and opulence of regal Rome. At that time the river was but a subordinate feature in the scene, lost, as it were, in the crowd of its accessories, and forming, like the Roman "girl of the period," described by Ovid, "the smallest part of itself."||

It appears from this that the Romans had succeeded in imparting an ornamental character to their river, and rendering its borders an eligible site for country houses. For this purpose they must have removed the mud as soon as the inundations subsided, and paid constant attention to the condition of the banks; which then, perhaps, ascended in gentle slopes from the river, or were cut into terraces, and planted with ornamental shrubs. It seems that the Romans had taken their river for better and for worse, and resolved to turn its capabilities, whether for use or ornament, to the best account; though as Tacitus informs us, they had abandoned all hope of regulating the volume of its waters. We, too, shall fail, I am convinced, in our attempts to prevent its inundations; but

\* Pluribus prope solus quam cæteri in omnibus terris amnes accolitur, aspiciturque villis.—Plin. III. (9), 54. Teub.

† Θύμβρις ὑβρῆιτις ποταμῶν βασιλευτατος ἄλλων ["Dionysii Alexandrini τῆς οἰκουμένης περιήγησις. Line 353, Lutetiae, MDXLVII."]

‡ ..... et sævum gentibus amnem.

Tibridis in morem domibus prævalet amœnis.—De laudibus Stiliconis.

|| Pars minima est ipsa puella sui.—Ovid. Rem. Am. 344.

we may, as I shall hereafter shew, foresee both the height of the floods, and the time of their occurrence, and place our moveable property out of reach of damage. We may also, like the Romans, speedily repair the mischief it has done, and obliterate the traces it has left behind. Though we cannot persuade ourselves that its colour is a beauty, we may prevent the river from continuing to be an eye-sore, and set it off, like a plain woman, by a becoming dress. The banks of the Tiber may again be lined with the villas of the citizens, and stately mansions once more be reflected in the waters of the fine reaches which extend above the Ponte Molle.

I will now give a description of the Tiber and its tributaries, and notice the most remarkable inundations which have occurred in ancient or modern times. I will then proceed to examine the theories which have been propounded to account for these inundations, and the schemes which have been devised to prevent their recurrence. Most of these, as I shall attempt to shew, are based upon false assumptions, or conceived in ignorance of the first principles of science. They must, therefore, result in failure, and in the loss of the money expended, whether by private speculators or the state.

## DESCRIPTION OF THE TIBER.

Though the Tiber is insignificant in size compared with the great rivers of the world, it is one of the most famous, and even its tributaries, down to the smallest brook, have some historical or poetic association connected with them, or exhibit some singular natural peculiarity. Its stream is swelled by the superfluous waters of the historic Thrasymerne; its affluents, the Velino and the Anio, form the celebrated cascades of Terni and Tivoli; the Clitumnus and the Nar are invested with poetic interest by the verses of Virgil, Ovid, and Silius Italicus; while the Chiana presents the singular phenomenon of a river which, within the historic period, has divided itself into two, and now forms a connecting link between the Arno and the Tiber, discharging a portion of its waters into each. The smaller streams, also, the Cremera, the Allia, and the Almo, have each their legend, historical, or mythological; while the rivulet of the Aqua Crabra, or Marrana, recalls the memory of Cicero and his litigation with the company which supplied his establishment at Tusculum with water from the brook.

The Tiber rises nearly due east of Florence, and on the opposite side of the ridge which gives birth to the Arno. It issues in a copious spring of limpid water, which at the distance of a mile has force enough to turn a mill. If we are to believe Bacci, it exhales so warm a vapour that snow, notwithstanding the elevation of the region, will not lie along its course within half a mile. For a distance of fifty-six miles it flows in a south-easterly direction through an elevated valley, in the upper part of which the cold, according to Pliny the younger, who had a villa there, was too great for the olive, and where the snow often accumulates to a considerable depth. Not far from Perugia it turns to the south,

and about fourteen miles lower down by the windings of the stream, receives its first affluent the Chiascia, which brings with it the Topino (anciently Tineas), and the waters of the classic Clitumnus, known to the readers of Virgil,\* Propertius,† and Silius Italicus‡ as the river on whose banks were bred, and in whose stream were washed, the milk-white oxen "which drew the Roman triumphs to the temples of the gods," and the same which is so picturesquely described by the younger Pliny.¶ At a place called le Vene, one of the sources of the Clitumnus rises at the foot of a hill. Like the fountain of Vauluse, it issues a small river from the earth, and, according to Pliny, had sufficient depth of water to float a boat. It is clear as crystal, delightfully cool in summer, and of an agreeable warmth in winter. Near it stands a temple once sacred to the river god, but now surmounted by the triumphant cross. It seems to have been a favorite place of resort for the Romans, as far as their limited means of locomotion would permit; since even the ferocious Caligula, as Suetonius tells us,§ attended by his body-guard of Batavians, was among the visitors to these celebrated springs. The beauty of the scenery appears to have been the attraction; for there were no mineral sources, and a refined superstition would have prevented the Romans from availing themselves of the agreeable temperature of the water to indulge in the luxury of bathing, rivers near their sources being accounted sacred, and polluted by the contact of a naked body. Of all the misdeeds of Nero none, perhaps, contributed more to his unpopularity than his swimming,¶ during one of his drunken

\* Hinc albi, Clitumne, greges, et maxima taurus  
Victima, sæpe tuo perfusi flumine sacro,  
Romanos ad templa Deum duxere triumphos.—Vir. Geo. II. 146.

† Qua formosa suo Clitumnus flumina luco,  
Integit, et niveos abluit unda boves.—Pro. II. 19.

‡ Et lavat ingentem perfundens flumine sacro  
Clitumnus taurum.—Sil. Ital. VIII. 516.

¶ Plin. VIII. Ep. 8.

§ Suet. Cal. 43.

¶ Tac. An. XIV. 22.

frolics, in the source of the Aqua Marcia, the same which is brought by the aqueduct to Rome, and which rises in the mountains of the Abruzzi, where Nero was staying at the time.

When the news of this act of profanation arrived in the city it created a great sensation, and an illness with which he was shortly afterwards seized was attributed to the anger of the god.

Seven miles lower down on the right the Tiber receives the Nestore, a large and impetuous torrent, or torrentaccio, as it is called by the Italians. The Nestore, where it enters the Tiber, flows in a bed of sand and shingle no less than a third of a Roman mile in width,\* and after heavy rains must bring down an enormous body of water. Into the Cina, one of its tributaries, by means of a tunnel, the overflow of the lake of Thrasymene is discharged. The emissary originates in the south eastern bay of the lake, but when, or by whom, the work was executed is matter of dispute. Thirty and a half miles further on, the Tiber is joined by the Chiana (anciently Clanis), which, after uniting with the Paglia, flows into it on the same side as the Nestore, and in the neighbourhood of Orvieto.

The Paglia rises in the high volcanic mountain of Monte Amiata, and in summer is nearly dry; but its broad stony channel at Acquapendente shows what a contribution it must bring to the main stream in time of floods. The Chiana, which from the black and muddy colour of its waters has received the name of the Lethe of Tuscany, but which might with more propriety be called the Tuscan Cocytus, was once a single stream originating in the neighbourhood of Arezzo, and flowing southward into the Tiber. But in the middle ages a large portion of the valley in which it flowed was filled up by the debris which in time of floods was brought down by the lateral torrents. A sort of plateau was thus formed, sloping at its edges towards the vallies of the Tiber and the Arno.

\* Gambarini and Chiesa.



The streams which entered this plateau stagnated in the dead level which it formed, converting it into an unproductive and unhealthy marsh, the abode of malaria and the pest-house of Dante's Purgatorio.\* They then flowed over the northern and southern edges of the plateau, and, uniting with others, formed two distinct rivers called the Tuscan and Roman Chianas.

The torrent of the Tresa, rising not far from the lake of Thrasymene, and now diverted into the lake of Chiusi, may be considered as the head waters of the Tuscan Chiana, the torrent of the Astrone, rising in the direction of Montepulciano, as the main branch of the Roman Chiana. The two are connected by canals and wet ditches, so that it is conceivable that a small piece of wood thrown into one of these might, according to circumstances and the direction of the wind, find its way to Florence or to Rome.†

The district which I have described, the celebrated Val di Chiana, is now one of the most productive regions of Italy, green with vineyards and pastures, and golden with waving crops. Nor is it unhealthy, except in the immediate vicinity of the lakes. The change was effected by canalizing the streams, and by the process called warping, which is the

\* Qual dolor fora, se degli Spedali,  
Di Val di Chiana tra'l Luglio e'l Settembre,  
E di Maremma et di Sardigna i mali,  
Fossero in una fossa tutti insieme.—Inf. Cant. 29, 46.

† A similar phenomenon is observed on a much larger scale in the province of Columbia in South America, where the upper Orinoco, on the plateau of Esmeralda, sends off a branch which joins the Rio Negro, a large affluent of the Amazon, thus connecting the water systems of those two great rivers. This branch called the Cassiquiare, before it loses itself in the Rio Negro, becomes a river as large as the Rhine.—*Mrs. Somerville and Elisée Reclus*. In an uninterrupted voyage of 920 miles, Humboldt penetrated through a remarkable network of rivers, from the Rio Negro, along the Cassiquiare to the Orinoco. Humboldt's "Aspects of Nature." It appears from this that a person may enter the Amazon, and after sailing many hundred miles across the continent of South America, descend the Orinoco to the sea. Such a feat could not be accomplished in the case of the Tiber and Arno, because the Roman Chiana is not navigable even for small boats, and the Tuscan Chiana, or canal of the Chiana, as it is called, is of still smaller dimensions.

method adopted in Lincolnshire for reclaiming land from the sea. A certain space was enclosed with banks, into which the streams were diverted when they were swollen and charged with mud. The opening was then closed with a floodgate, and the water left to deposit the matter which it held in suspension. In this way an inch or two of soil was gained every year, until the land became sufficiently dry and firm. It was then sown with crops, and planted with trees, which served still further to purify the air by decomposing with their leaves and fixing in their tissues the vapours which had given the Val di Chiana so deadly a name.

Turning again to the south east and at a distance of 136½ miles from its source, the Tiber is swelled by the united streams of the Nera, the Velino, and the Salto. The Nera, the "sulphurea Nar albus aqua" of Virgil, and "Narque albescentibus undis" of Silius Italicus, rises at the foot of the lofty peak of Monte Vettore, part of the Sibylline range, and is the tributary which is most affected by the melting of the snows.

The Velino also has its source in the great central chain of the Apennines, and after being joined by the Salto and Turano, forms the cascade of Terni by dashing over the precipice which terminates the valley, and hastens to meet the Nera. The Salto, rising in the kingdom of Naples, flows northward for fifty miles, and after passing beneath the lofty range of Monte Velino, and receiving a contribution from its snows, mingles its waters with the Velino. Swelled by these tributaries the Nera rolls along a full and rapid stream, and sweeping past Terni and Narni, loses itself in the Tiber.\*

The plateau of Rieti, embosomed in mountains, through which the Velino flows for thirty miles before it precipitates itself over the escarpement of the tableland into the valley of the Nera, has a history more remarkable even than that

\* The Nera contributes to the Tiber more than half its volume of water. Hence the saying of the Romans:

Il Tevere non sarebbe il Tevere  
Si la Nera non gli desse da bere.

of the Val di Chiana. Nothing certain is known of its condition before the age of Curius Dentatus, the conqueror of Pyrrhus and the Samnites. At that time the outlet of the Velino had been wholly or partially closed by the calcareous deposits from the river called Travertino, and the water spread itself over a large portion of the tableland, forming a succession of lakes and marshes. These not only occupied the space which might have been devoted to tillage, but tainted the atmosphere during the summer months. The case was still worse after heavy rains. The lakes extended themselves over a wider area, filling the whole plain between the mountains, until the excess of water escaped over the brow of the precipice in which the plateau terminates.

To remedy this state of things, Curius Dentatus cut a new channel for the river, by which the marshes were drained and the lakes confined within narrow limits, the Velino being discharged over the cliffs into the valley beneath, and forming the original cascade of Terni.

For many years this plan succeeded, and the plain of Reate, the "Rosea rura Velini"\* of Virgil, became one of the richest and most healthy districts of Italy. Equally productive, and far more picturesque than the Val di Chiana, it received the name of the Roman Tempe.

There was another party, however, who were not equally satisfied with the change. The people of Terni, who dwelt below the fall, declined to receive the superfluous water of the people of Rieti. The evaporating surface being diminished by the drainage of the lakes and marshes, the volume of water in the Velino, where it joins the Nera, was considerably increased, and the people of Terni, or Interamnates, as they were then called, complained that their lands were laid waste by the torrents which in time of floods poured over these newly-created falls.

\* *Æn.* vii. 712. The name "Rosea" is undoubtedly derived from "ros" "den." The fertility for which these plains were celebrated was owing to the exhalations from the Velino lake.

Up to the time of the Empire they continued to petition the senate to put an end to the inconveniences which they suffered, by blocking the outlet of the Velino. This petition it was of course impossible to grant; for the interests of the people of Reati were of more importance than those of the people of Terni. On one occasion we learn that the latter had recourse to legal proceedings, and brought an action for damages against the former,\* who secured the services of Cicero to plead their cause. "His rebus actis, Reatini me ad sua *τέμνη* duxerunt ut agerem causam contra Interamnates apud consulem et decem legatos, quod lacus Velinus à Marco Curio emissus, interciso monte, in Narem influit, etc.," *Ad. Attic.* vi. 15. It is not known what was the decision of the consul and the ten commissioners, but probably it was favourable to the case of the Reatini, since the emissary was allowed to remain unchanged.

At length a new cut was made by order of the Emperor Tiberius, which appears to have had the effect of removing many of the evils complained of, for we hear nothing more of the matter until the fourteenth century.

Meanwhile a change had come over the valley of Reati. The outlet of the Curian canal was again closed by incrustations, and again the valley suffered from inundations and stagnant water. The position of the parties was now reversed. The people of Terni wished to leave matters as they were, the people of Reati to relieve themselves of the redundant water. An attempt of the latter to open a new channel was opposed by the former, and a contest ensued in which many lives were lost. A petty prince Braccio da Montone,† called by historians the tyrant of Perugia, then interfered and insisted upon a new

\* The passage of Cicero is corrupt, and obscure, and is differently explained; some supposing that the action was brought by the people of Reati against the Interamnates in consequence of the interference of the latter with the tunnel.

† Braccio da Montone, a celebrated captain of free-corps in the 15th century, had made himself master of Perugia, his native town, as well as of Rieti, and was for some time in possession of Terni. He had, therefore, a personal interest in settling the dispute between the two latter towns. See Muratori, *Annali d' Italia, Era vulgare*, Anno 1416....1421.

channel being dug. But this was of small dimensions, and soon filled by the calcareous deposits. In 1546 Paul III. visited the spot in person in order to reconcile the differences of the contending parties. He ordered three additional openings to be made, imagining that a great deal of the water in descending from such a height would be lost in spray, so that the volume of water in the Velino would thereby be diminished. Strange to say, the strongest opposition was offered to this useful work. Not only Terni, and the other cities below the falls, but even Rome remonstrated against the scheme. It was imagined in those times that the large body of water brought down by the Velino after heavy rains was the chief cause of inundations in the low country, and Bacci, whom I have mentioned as the author of a book upon the Tiber, held this opinion among the rest. The work, nevertheless, proceeded, but, like all the plans which had been tried before it, proved a failure. At length, after another unsuccessful attempt by Fontana in 1596, the present channel was formed in the year 1785, and in the pontificate of Pius VI., and has ever since answered its purpose.

About sixty-four miles lower down, and four and a half above Rome by the river, the Tiber is joined by the Anio, or Teverone, the most important, with the exception of the Nera, of all its tributaries. No river is better known than the Anio. The scenery of its valley, the classical associations of its neighbourhood, and the celebrated cascades of Tivoli, have made it the favourite resort of tourists; and full descriptions of the most interesting sites, and directions for reaching them in the most convenient manner, may be found in the popular guide books. I shall confine myself, therefore, to the physical characters of the river, and to a short notice of the aqueducts which were supplied from it, or from its tributaries. The Anio rises in the mountains of the Hernici, part of the modern Abruzzi, and after flowing for about thirty-six miles through a narrow valley whose general course is to the west, precipitates itself into the gorge which is overlooked by the town of Tivoli; emerging from which it turns west-south-west and joins the Tiber after a further course of twenty miles. Midway between its source and Tivoli; it passes

the town of Subiaco, anciently Sublaqueum, which derives its name from three picturesque lakes, "tres lacus amœnitæ nobiles" (Plin. III. 12) which formerly existed there.\*

Tivoli is well known to have been the favourite retreat of the wealthy Romans from the turmoil, and what Horace calls the "fumus," of Rome.† The names and the ruins of these villas yet remain, but no trace is left of those which once adorned the banks of the Tiber, and perhaps of the Anio in the lower part of its course.

Pliny the younger calls the Anio "delicatissimus amnium," "softest and gentlest of rivers" (Ep. VIII. 17), and adds "that it was for this reason invited, as it were, and retained by the neighbouring villas"‡ for their own exclusive use. Yet this "delicate river" indulged occasionally in the wildest escapades, and Pliny himself, in this very letter, describes an inundation in which it swept away woods, undermined hills, and committed extraordinary havoc among the neighbouring farms. (See Letter). From this time to the year 1826 it was a constant source of apprehension to the people of Tivoli, and of anxiety to the government at Rome, which expended considerable sums in trying to prevent some great calamity, or in repairing the damage which had been done. Once since the time of Strabo the river is thought to have changed its course, discharging itself at a lower level into the Grotto of Neptune, but still forming a lofty and picturesque cascade.

At different periods it had destroyed buildings, undermined the foundation of others, and defied every effort to control its violence. At length these floods culminated in the great inundation of 1826, which entirely altered the character of the cascade, and necessitated the formation of the tunnel through Monte Catillo. In consequence of heavy and continued rains,

\* These lakes were artificial and attached to the villa of Nero.

† Omite mirari beatæ

Fumum et opes strepitumque Romæ. Hor. Car. III. 29.

It is strange that most commentators should hesitate to render "fumum" "smoke" and explain it by vain and empty pomp; as if there were no smoke from wood fires, as well as other disagreeable vapours at Rome.

‡ "Adjacentibus villis velut invitatus et retentus."—Plin. Ep. VIII. 17.



which fell in the middle of November, on the sixteenth the Anio rose to an extraordinary height. Trunks of trees and cabins of shepherds, borne along on the surface of the boiling flood, told the story of the havoc which the river was committing in the upper country; while the roar of the waters as they discharged themselves over the cascade struck terror into the hearts of those whose houses adjoined the falls. As they were gazing on the grand but fearful spectacle, on a sudden the river was seen to change its course, and diverging to the right, to open for itself a new channel, which the rush of the waters contributed every instant to deepen. The cascade became a rapid, and as the friable soil yielded to the violence of the current, a ravine was opened nearly thirty feet in depth. The foundations of the houses situated near the river were undermined, and a whole street, the church of St. Lucia, and half the palace of Boschi, sank into the yawning gulf, along with the vineyards and gardens beside them.

Meanwhile the mills and manufactories which had been supplied with water from the river were left dry by the sinking in the level of its bed; their works were suspended, and there was a prospect that for an indefinite period the workmen might be thrown out of employment.

When the flood had subsided, the first care of the authorities was to restore the water to the suspended works; for the stoppage of the flour mills had caused great distress, and the suspension of those for crushing the olives would have entailed great loss on the district, as the last crop of that fruit had been unusually abundant. By means of canals drawn from a higher level the mills were at length set in motion, and the thoughts of the government, after relieving the immediate distress, were turned to the means of repairing the damage and preventing similar disasters in future.\*

Among many proposals made to the Papal government, was one for diverting the river by a tunnel through Monte Catillo; but at the time it was considered too difficult and too ex-

\* Il fiume l'Aniene, by an inhabitant of Tivoli.

pensive, and it was therefore resolved to restore the cascade, with some modification, and to strengthen the natural pillar which supports the roof of the grotto of Neptune, the destruction of which, it was thought, would lead to the fall of the cliff on which stands the temple of the Sibyl, with other monuments of antiquity. The pillar was surrounded with stout oak planks firmly braced with iron, forty great beams of oak, and four others of less thickness; thirteen hundred pounds of iron, and five hundred of lead being employed. But on the twenty-eighth of December, 1831, there came another great flood, and the river beat with such fury against the grotto and the pillar, that not a vestige remained of the stout covering of the latter, and further progress was made in the corrosion of the pillar itself. The proposer of this plan of strengthening the support could only exclaim, when he saw the havoc which had been wrought, "It seems impossible, and yet it is a fact."

At length it was seen that nothing but the diversion of the river could prevent the undermining and fall of the cliff, and with it the destruction of the temple of the Sibyl, and of a portion of the town. For the substance of the cliff is neither the close-grained Travertino used in building, nor the hard secondary limestone of the Apennines, like that of Monte Castillo, but a porous, spongy deposit, called by the Italians 'tartaro,' which is deposited by the river under certain conditions, and corroded by it under others.

It was decided, therefore, that the tunnel should be commenced. The work was let on contract to two rival firms, and pushed forward with such vigour that, though it was considered a most arduous undertaking in those times, it was completed in 1836, during the Pontificate of Gregory XVI.

From the Anio, or its tributaries, was drawn the water which supplied the principal aqueducts of Rome, the Anio Vetus, the Marcia, the Anio Novus, and the Claudia. When the original Aqua Appia and Anio Vetus were found insufficient for the increasing wants of Rome, it was resolved to seek for a fresh supply. This was found in a stream of limpid water rising about thirty-six miles from Rome in the Marsian

mountains, and flowing into the Anio. As the water of the Anio Vetus was often turbid after rain, and even the Piscina, or reservoir, through which it was made to pass, often failed to purify it, Quintus Marcius Rex, who was appointed to superintend the work, was desirous that the water of the new aqueduct should be taken from one of the tributaries of the river, and as near as possible to its source. The scheme, Frontinus tells us was nearly failing owing to a superstitious scruple. The work had actually been commenced, when the decurions fancied that they had discovered in the Sibylline books a prohibition against using the stream in question, and a command, that the water required should be taken from the river. The matter was debated for some days in the Senate, but the influence of Marcius prevailed, and the work was allowed to proceed. As the source was in the country beyond the Anio, the aqueduct was of course more expensive than any of the preceding ones, and the entire length was no less than sixty-one miles, of which six were on arches, the rest being subterranean. But, if the expense was greater, the quality of the water was superior to that of any other with which Rome was acquainted. Strabo (v. c. 240) describes it as "distinguished for its excellence above all other waters,"\* and Pliny† observes: "that the Marcian, most limpid of all the waters in the world, and by the verdict of the city carrying off the palm for coolness and salubrity, is undoubtedly a gift of heaven to the State." Both authors describe it as passing from lake Fucinus through a subterranean channel, which had its opening in the valley of the Anio. Pliny makes it perform a longer and stranger pilgrimage‡—"It rises in the farthest mountains of the Peligni, crosses the Marsi, and the lake Fucinus, making straight for Rome. Bye-and-by it sinks into caverns, and comes to light again in the territory of Tibur." It is needless to observe that all this is fanciful, and that the springs of le Serene, from which

\* "Παρά τὰ ἄλλα ἐνδοκιμώυτος ὕδατα."—Strabo, v. c. 240.

† Pliny, XXI. 24.

‡ "Oritur in ultimis montibus Pelignorum, transit Marsos et Fucinum lacum, Romam non dubie petens. Mox in specus mersa in Tiburtina se aperit."

the larger portion both of the ancient and modern Aqua Marcia is derived, have no connexion with lake Fucinus. A short description of the modern aqueduct may be found in the last edition of Murray. The Aqua Marcia was valued for its limpidity and freshness, and Statius describes it as bringing with it to Rome the coolness of the Marsian hills in which it rose.

..... Marsasque nives, et frigora ducens

Marcia, I, 5, 26. Balneum Claudii Etrusci.

Tibullus also, III. Eleg. 6, 58, alludes to its potable qualities:

Temperet annosum Marcia lympa merum.

Subsequently, when the Anio Novus and Aqua Claudia were brought to Rome, great abuses began to prevail. The Aquarii, or watermen (Frontinus, Art. 91), used to supplement, more freely than was required, the deficiency of the Aqua Marcia, and the Aqua Claudia—which also was supplied from springs—with the abundant, but more turbid water of the Anio Novus. The fullones, or fullers, also took a fancy to the Aqua Marcia, thinking that it improved the appearance of their cloth, and it was also employed, as Frontinus complains, for purposes too foul to be mentioned. A regulation, therefore (Frontinus 92), was made that the Marcia should be reserved exclusively for drinking, "potui tota serviret," and that the waters of the other aqueducts should be applied, according to their qualities, to the purposes for which they was best suited, the Anio Vetus, for instance, to watering gardens, and to the requirements of cleansing a city.

The aqueducts of the Anio Novus, and the Aqua Claudia, of which I have spoken, were completed in the reign of Claudius. The Aqua Claudia, which came from springs, was nearly equal in quality to the Marcia, while the two Anios were often turbid, even in fine weather, from the falling in of their banks (Frontinus, Art. 90). But Claudius improved the quality of the Anio Novus, by abandoning the river at the point from which the water had been drawn, and taking it from a lake, out of which the stream issues limpid, after having deposited the greater part of its impurities.

Altogether, according to the calculation of Fea, half the volume of the Anio was abstracted by the four aqueducts which have been mentioned.

Four tributaries remain to be described—the Cremera, the Allia, the Aqua Crabra, and the Almo—streams insignificant in size, but famous in the annals of Rome, or possessing an interest for the classical scholar and the archæologist. The Cremera, a mere brook, over which an active person might leap, rises in the little lake Baccano, and flowing past the site of Veii, crosses the Flaminian way about six miles from Rome. This brook must not be confounded with another a little higher up, and which is a rivulet unknown to fame. The Cremera is associated, as every student of Roman history is aware, with the patriotic devotion of the Fabii, whose story may be found in Livy, II. 48, 49, 50.

On the banks of the Allia, the “*flebilis Allia*” of Ovid, a still smaller stream, though dignified by the historians with the name of river, was fought a battle with the Gauls, in which the Romans sustained a signal defeat. Ovid thus alludes to the event:

Tunc licet incipias qua flebilis Allia luce  
Vulneribus Latiis sanguinolenta fuit.—*Ars. Am. I.* 413.

The disastrous result of this battle is known to all, but comparatively few are acquainted with the details. The subsidia, or reserves, who occupied a strong position, made some resistance, but the legionary soldiers on the left wing were seized with a panic, and fled before they had received a wound, and almost before the enemy were in sight. Casting away their arms, they unaccountably made their way to Veii across the Tiber, instead of to Rome, which was on their side of the river. There was, therefore, no slaughter of combatants, but only of fugitives, who were cut down in the rear, as they impeded each others' flight, or were helplessly slaughtered on the banks of the Tiber, before they had time to cross the river. Many also were drowned, borne down by the weight of their armour; but the larger portion reached Veii in safety. It was the Tiber, therefore, rather than the Allia, which was “crimsoned

with Latian blood.” For the line of the Allia had been abandoned, as we have seen, without a struggle, and even without a wound. See Livy, v. 38. The right wing retreated unharmed to Rome.

The Allia cannot be identified with certainty, but it is supposed to be a small stream flowing in a deep ravine, which joins the Tiber on the side opposite to Veii, and about three miles above Castel Guibileo, the site of the ancient Fidenæ. This stream agrees with the description of Livy.\*

The Aqua Crabra is generally known by the name of the Marrana, but is also called Aqua Mariana, and Marrana del Maria; Marrana being a name frequently given to brooks by the modern Romans. Thus we have Marrana della Caffarella, another name for the Almone, and Marrana di Grotta perfetta. The rivulet anciently known by the name of the Aqua Crabra rises in the heart of the Alban hills, and after passing beneath the heights on which Tusculum and Frascati are situated, turned northward in obedience to the configuration of the ground, and flowed into the Anio. But, at some unknown period after the fall of the Roman Empire, it was diverted by means of a tunnel into the channel in which it at present runs, for the purpose of turning mills and irrigating the land. The little stream, also, which flows in the valley between Marino and the ridge encircling the Alban lake, whose source is considered by some to be the Aqua Ferentina of Livy, is conveyed through a similar tunnel to swell the scanty waters of the Aqua Crabra. In ancient times this rivulet was considered of such importance to the people of Tusculum, who lived out of the way of the great aqueducts, that Agrippa, as Frontinus tells us, consented not to turn it into the “caput,” or well head, of the Aqua Julia, as he had originally proposed. It was looked upon as a treasure to be doled out in measures to the thirsty people of Tusculum, and was often contended for by legal proceedings. Cicero, in his oration *de lege Agraria*, III. 2, informs us that he paid rates to the authorities of Tusculum for his share of the precious fluid. “*Ego Tusculanis pro aqua Crabra vectigal*

\* “*Crustuminiis montibus præalto defluens alveo.*”—Livy, v. 37.

pendam," and in his oration pro Balbo, ch. 22, he refers to a litigation with the municipality which furnished the water, probably on account of the deficient supply. In this action "he was in the habit," he tells us, "of consulting the lawyer, Tugio, on account of his long experience in similar cases." "Si nos de aqua nostra Tusculana M. Tugionem potius quam C. Aquilium consulebamus, quod assiduus usus uni rei deditus et ingenium et artem sæpe vincit." Tugio seems to have justified his choice, and to have frightened the municipality into granting a more abundant supply, for we find Cicero in his letter to Tiro, Ep. ad Fam. xvi. 18, observing, "that now there was more water than enough." "I should like to know," he says, "how the business of the aqua Crabra is going on, though now indeed there is more water than enough." "De aqua Crabra quid agatur, et si nunc quidem nimium est aquæ, tamen scire velim."

The Almo, "cursuque brevissimus Almo," of Ovid Met. xiv. 329, is the stream which flows in the valley of Caffarella, close to the Nymphæum, which does duty for the grotto of Egeria. Its most remote source is about six miles from Rome, in the direction of Albano, and this is usually dry; so that the Almo is with great propriety called "brevissimus," in comparison with the other rivers which Ovid is enumerating. The perennial source is at Aqua Santa, not more than three miles from the city. The stream that rises in the valley between Marino and the Alban lake is represented in most maps as flowing into the Almo. It is really diverted by a tunnel into the Aqua Crabra.

At the junction of the Almo with the Tiber were washed every year, the statue of the Goddess Cybele, her chariot and the sacred instruments of her worship. Ovid thus describes the ceremony:

Est locus in Tiberim qua lubricus influit Almo,  
Et nomen magno perdit ab amne minor.  
Illic purpurea canus cum veste sacerdos  
Almonis dominam sacraque lavit aquis,  
Exululant comites, furiosaque tibia flatur,  
Et feriunt molles taurea terga manus.—Ov. Fasti, iv. 337.

And Lucan alludes to it thus:

Qui lotam parvo renovant Almone Cybebem, l. 600.

Among the remaining tributaries of the Tiber may be enumerated the Farfarus, which is a torrent joining the Tiber on the left a little above Correse. It is mentioned by Ovid along with the Nar:

Narve tulit præceps, et opacæ Farfarus undæ.—Ov. Met. xiv. 330.

Also the little stream, the Aqua Albana, which is discharged by the emissary of the Alban lake, a work executed three hundred and ninety-three years before Christ. For the circumstances which led to its formation, see Livy, v. 15, 16.

The caput Ferentinum, into which Appius Herdonius, the personal enemy of Tarquinius Superbus, was plunged, and kept down with a hurdle until he was drowned, has been before referred to. Murray, or the authors whom Murray has consulted, and Nibby, place it where it is most natural that it should be placed, near the town from which it derives its name, and in the valley between Marino and the Alban lake. A German, author of a description of Rome and its environs, has discovered a new site for it in the Campagna, while Rosa, curator of the Palatine, identifies it with a spring, which, rising near the summit of the Alban mount, loses itself in the earth before it reaches the foot of the hill. One can only exclaim, when those who profess to have studied the question differ so widely:

Who can decide when doctors disagree,  
And Nibby, Rosa, doubt like you or me?

The story may be seen in Livy, i. 50, 51.



## COMMENTS ON GIBBON.

In the seventy-first chapter of Gibbon we have the following observations: "From its situation Rome is exposed to frequent inundations. *Without excepting the Tiber*, the rivers which descend from either side of the Apennines have a short and irregular course; a shallow stream in the summer heats, an impetuous torrent when it is swelled in the Spring or Winter by the fall of rain or the melting of the snows. When the current is repelled from the sea by adverse winds, when the ordinary bed is inadequate to the weight of waters, they rise above their banks and overspread, without control, the plains and cities of the adjacent country." Afterwards, in describing a particular inundation, he speaks of the buildings of Rome as being undermined by the long continuance of the flood.

This is a most inaccurate description of the Tiber, and confirms what I have elsewhere observed, that those whose pursuits are exclusively literary are never shrewd observers of natural objects, or of the phenomena of nature. The power of discovering substantial agreement amid apparent difference, and of detecting essential difference beneath superficial resemblance, constitutes a science in itself and requires a special training. Accordingly, we find that Gibbon, Arnold, and many others, adopt popular notions in science which they have neither the time nor the inclination to investigate, and give them additional currency by impressing them with the stamp of their genius, and clothing them with the graces of their style.

Nothing which is said of the other streams which descend from the Apennines is applicable to the Tiber. Measured by an English standard, the Tiber cannot be called a river whose course is short; for its length, from its source to Rome, exceeds that of the Thames from its most remote fountain

in Gloucestershire to Gravesend. The long continuance, also, of the inundation described by Gibbon is inconsistent with the shortness of course which he attributes to the Tiber; for mountain torrents, like the Trebbia and Reno, subside as rapidly as they rise.

Neither is the Tiber a shallow stream, or nearly dried up in summer, as the reader might infer from the language of Gibbon. It is nowhere fordable in the neighbourhood of Rome, and it is only for a short time during the droughts of summer that the navigation by small steamers from Rome to Scorano is suspended. Formerly they ascended as high as Ponte Felice, which is distant about fifty miles from the city.

Yet the words of the historian would convey the impression that the appearance of the Tiber in the summer months resembles that of the torrents which descend from the Northern declivity of the Apennines to join the Po. The traveller from Bologna to Turin crosses half-a-dozen, or more, wide beds of mountain torrents, spanned by bridges of eight, ten, or twelve arches. These beds of torrents present nothing to the view but a wide waste of sand and shingle, the whole of the scanty stream, which flows in them during the summer season, being diverted for the purpose of irrigation. Among these are the Reno, near Bologna, and the Secchia, the Tara, and the Trebbia, famous for the defeat of the Romans by Hannibal, but robbed, like the rest, of its water for the use of the agriculturist. I have also seen the Arno, when the rivulet, which threads its way through mud and sand in the month of August, had been turned through the dairy farm of the late Duke of Tuscany, so dry, below the town of Florence, that a person might have picked his way across it, without wetting anything but the soles of his shoes.

Far different is the appearance of the Tiber in the summer months. At a point, where I ascertained it by measurement to be five hundred feet wide in the month of July, it was not only deep enough to float a large row-boat, but flowed with a swift current, so that it must have discharged a great body of water. Where the Thames, above the influence of the tide

is widest—and no where is it wider than four hundred feet—the current in dry weather is scarcely perceptible.

From my observation of the river at the point indicated, coupled with the strength of the current, I feel not the slightest doubt that the volume of water in the Tiber, during the summer, is equal to that of the Thames and Severn put together, while in the winter the disproportion is greater still.

### NAVIGATION OF THE TIBER.

When the Romans, after the burning of their city by the Gauls, were deliberating about migrating to Veii, whose buildings, far exceeding in splendour those of Rome, remained intact, Livy puts into the mouth of Camillus a speech in which he tries to dissuade them from their design. After enlarging upon various considerations, which should induce them to remain, such as their religious rites, which could be fitly performed only in their ancestral city, and the recollections connected with their native land, which furnished a never-failing stimulus to deeds of heroism, he goes on to notice the advantage which Rome enjoyed over Veii, in the possession of a navigable river, by means of which corn could be floated down from the interior, and the produce of other regions received from the side of the sea.\* The arguments of Camillus prevailed, and the Romans remained, to turn to account the natural advantages of their city, and to render Rome the mistress of the world.

The river appears to have been utilised to a far greater extent in ancient than in modern times. Pliny, the elder, tells us that the water of the Tiber above Perugia, as well as that of the Tineas (Chiascia), and of the Clanis (Chiana),

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\* Non sine causa Dii hominesque hunc urbi condendae locum elegerunt, saluberrimos colles, flumen opportunum quo ex mediterraneis locis fruges devehantur, quo maritimi commeatus accipiantur. Livy, V. 54.

See, also, Cicero de republica, II. v. 10, where, while using nearly the same language as Livy with regard to the Tiber, he styles the river "perennis," which is true; for, unlike the Arno, it flows with a full and strong current, even in the heats of summer. But, at the same time, he strangely describes it as "equabilis," which is the reverse of truth; for few rivers vary so much in height, thirty-five to forty feet being the difference between the two extremes.

was dammed up, and if no rain fell within nine days, it was let out, to render these rivers navigable, or to increase the volume of water in the Tiber. The "muro grosso," or great dike on the Roman Chiana, below the town of Canagiola, which tradition assigns to Nero, is thought to be part of a larger work, constructed by the Romans, for the purpose of retaining the water of that river. Strabo\* informs us that not only was the Nar navigable for large boats, but that smaller ones descended the Tineas, and conveyed to the Tiber the produce of the country on its banks; and Piso, the reputed poisoner of Germanicus, is said, by Tacitus, to have embarked at Narni on the Nar, and descended that river and the Tiber to Rome.

According to the historian,† his object in taking this route was to avoid the suspicion of tampering with the legions, whose favourite he was, on account of the licence in which he allowed them to indulge. Perhaps, also, he was fearful of attracting the notice of the people to whom he knew himself to be odious, before he arrived at Rome, and was surrounded and protected by his clients and retainers.

Such was the hatred with which he was regarded as the suspected murderer of the darling of the people, that an evil interpretation was put upon his most harmless actions. It was made a charge against him, that he had landed close to the Mausoleum of Augustus, as if his object were to insult that family, the noblest scion of which had just fallen a victim to his infernal arts.‡

But, whatever might have been the motives of Piso, there were doubtless many others who preferred the river to the high road, paved, as the latter was, with lava blocks, over which they were jolted in their springless cars.

It appears, also, from the account of Strabo, that the Anio, then, as now, was navigable from Tivoli to its junction with

\* Strabo, v. c. 253.

† Tac. Ann. III. 9.

‡ Tac. Ann. III. 9. See the romantic story of Germanicus and Piso in Tac. Ann. II. 69, 70, 71, 72, 75, and III. 1.

the Tiber; and he describes it as traversing a very fruitful plain in the neighbourhood of the quarries of Tiburtine and Gabian stone (Travertino and Peperino),\* and notices the great facilities which it afforded for the transport of those stones, of which the greater part of the public buildings of Rome were constructed. We read in Livy, iv. 52, that, during a famine, commissioners were sent to the people who inhabited the shores of the Etruscan sea and the banks of the Tiber, to purchase corn for the people, and that abundant supplies were conveyed down the river, "great earnestness being displayed by the Etrurians to furnish them." "Maximos commeatus summo Etruria studio Tiberis devexit." This corn probably came from the plains about Perugia, where it would be likely to be grown in larger quantities than elsewhere. According to Pliny, the younger, boats descended the Tiber from Tifernum, near which his villa was situated, to Rome, conveying to that city the produce of the upper country; "but only," he says, "in winter and in spring. In summer the river sinks, and presents nothing but a dry channel, where once was an immense river."† Tifernum, according to Cluverius, was Borgo San Sepulcro; according to others, Citta di Castello. Both towns are situated in the upper valley of the Tiber, where the river is nothing but a large mountain torrent.

Below the junction of the Nera, however, the Tiber was navigable for boats, like our barges, at every season of the year. The river above and below Rome, as well as in the city, must, in the time of the Empire, have presented a scene of life and animation strongly contrasting with its desolation in the present day. Propertius describes his friend Gallus as "flinging himself luxuriously beside the Tiber's waves, and while he quaffs Lesbian wine from vessels wrought by the hands of Mentor, admiring, at one time, the swiftness with

\* "Travertino," a yellowish limestone deposited from springs; "Peperino," a consolidated volcanic dust, or volcanic conglomerate, of a greyish colour, whence the name from "Pepe," "pepper."

† Plin. Ep. v. 6th section.

which the boats descended the stream, at another the slowness with which they are towed against it by means of ropes—

Tu licet abjectus Tiberina molliter unda  
Lesbia Mentoreo vina bibas opere :

Et modo tam celeres mireris currere lintres

Et modo tam tardas funibus ire rates.—*El. I. 14.*

In the present day, the boats which descend the stream are few and far between. One may stand on the Ponte Molle for an entire day without seeing the water enlivened by a single oar or sail. A solitary tug, once a week, is sufficient to tow, against the stream, all the barges which have descended the river within that time. This absence of traffic on the Tiber is owing partly to the competition of the railroad, which follows the valley of the river, partly to the uncultivated state of the Campagna, and partly to the impoverished condition of the towns on the Nera and upper Tiber, Terni, Narne, and Citti di Castello, which were comparatively flourishing in the time of the Romans.

Even below the city there is little life or movement. A steamer or boat of any description is rarely seen to come or go. But in the time of the Empire, the Tiber at the Ripa Grande must have been crowded with vessels, departing or arriving, laden with the precious productions of the East, or the corn with which the teeming multitudes of Rome were fed. For the “fruges” and the “res ad victum cultumque maxime necessariae,” which Livy and Cicero\* describe as being brought down the Tiber from the interior, had long since ceased to be produced. Italy, which once, not only fed her inhabitants, but exported corn,† was now occupied by the mansions and pleasure-grounds of the great and wealthy, or had become the vineyard, orchard, and kitchen-garden of the imperial city. Little, there-

\* Livy v. 54, and Cicero “De republica,” II. v. 10.

† At Heracle olim ex Italiae regionibus longinquas in provincias commeatus portabant; nec nunc infecunditate laboratur, sed Africam potius et Ægyptum exercemus, navibusque et casibus vita populi Romani commissa est.—*Tac. Ann. XII. 43.* These reflections were suggested by a riot in the reign of Claudius, consequent upon the dearth of grain and the high price of bread.

fore, either by land or river carriage, could be expected from that quarter, and the supply of corn was almost entirely confined to what arrived by sea.

Below Rome, the Tiber is said by Pliny, the elder, to have been navigable, not only for the barges, whatever their tonnage, which conveyed the merchandise to Rome, but for vessels of the largest size, sea-going vessels from the Italian seas; and Livy tells us that vessels of the royal navy of Perseus, “naves regiæ,” which were of a magnitude never before beheld, “invisitatae ante magnitudinis,” after their capture by the Romans, were brought up the Tiber as far as the Campus Martius; but as they were “subductæ,” or hauled up upon dry land, according to the usual practice, we cannot form a very exalted notion of their size. A nondescript craft, also, of unusual length, and impelled by no fewer than three-hundred oars, which had been built expressly to convey the Vatican Obelisk from Alexandria to Rome, came up the river as far as the vicus Alexandri, three miles below the town, whence the obelisk was transported on rollers to the Campus Martius. It appears, therefore, that a ship large enough to carry such a cargo across the Mediterranean was able to ascend the Tiber within three miles of Rome. We learn, however, from Strabo that the larger class of merchant vessels, which were impelled by sails, and, therefore, required a larger draught of water, were obliged to anchor in the open roadstead off the mouth of the Tiber. A portion of their cargo was then discharged into lighters, after which the vessels proceeded up the river to Rome.

But the ascent of the Tiber by vessels of war will not assist us in forming a conjecture as to its depth. The ancient gallies were built exclusively for offence and speed; they carried no stores for distant voyages, and were furnished with slender accommodation for their crews, or for the soldiers who fought aboard them as marines.\* Their displacement, there-

\* Thucydides informs us (IV. 26) that the Athenian vessels blockading Sphacteria were reduced to great straits by want of food and water, and



fore, was small, and they were easily impelled by oars against the current of the river. Merchant vessels, also, if their burden did not exceed three thousand modii, or thirty tons, ascended the river without difficulty (Lanciani, who quotes Rasi, and de Fazio); but if their tonnage exceeded that indicated, they were obliged, as I have said, to tranship a portion of their cargo. These merchant vessels were dragged against the stream, probably, as in the present day, by ropes attached to the horns of buffaloes. The monster galley, likewise, which bore the Vatican obelisk, whose extraordinary dimensions, as well as foreign and mysterious cargo, (must, Ammianus Marcellinus says, have frightened father Tiber out of his propriety),\* drew probably but little water, perhaps not more than the three feet eight inches, which in the present day is the minimum depth in summer below the city of Rome. Such a vessel, burdened with a deck-load of one million three hundred and one thousand four-hundred and seventy-four pounds, or nearly six-hundred tons, and loaded, besides, with four blocks of granite to form the pedestal of the obelisk,† must, notwithstanding the hundred and twenty-thousand modii of lentils which it carried as ballast, have run the risk in crossing the Mediterranean of sharing the fate of our Captain.

But, whatever might have been the depth of water when this vessel made the ascent of the Tiber, the river, owing to the annual deposit of mud, continued to become shallower, and the difficulty of navigation to increase. Caligula was obliged

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were obliged to take turns in going on shore to procure them. The crews of these galleys seem to have been always cramped for room, as they were sometimes stinted for food, and were glad when an opportunity presented itself of going on shore to stretch their limbs and take their meals in comfort.

\* .... tandemque sero impositus navi per maria fluentaque Tibridis, velut paventis deferatur.—Am. Mar. XIII. 414.

† Abies admirationis præcipuæ visa est in nave quæ ex Egypto Caii principis jussu obeliscum in Vaticano Circo statutum, quatuorque trunco lapidis ejusdem ad sustinendum eum, adduxit; qua nave nihil admirabilis visum in mari certum est. 120,000 modium lentis pro saburra ei fuere.—Plin. Lib. XVI. 76, 4.

to make use of a bireme, instead of a trireme, to convey the ashes of his mother and brother to Rome,\* and Claudius was enraged with the people of Ostia, because they had not sent scaphæ, or small boats, to meet him,† his own vessel being unable without difficulty to cross the bar.

At last the Emperors began to fear that the supplies of corn, for which Rome was dependent on the navigation of the Tiber, might fail, and, as "Panis et Circenses" were the two means by which the populace of Rome was kept in good humour,‡ it became a matter of vital importance to construct a new port, and improve the navigation of the river. Ostia had never been anything but an emporium, where ships might discharge their cargoes, if they were indisposed to make the tedious ascent to Rome, or ride at anchor protected from the storms of the Mediterranean by a bend in the river. A project, first conceived by Julius Cæsar, was carried out by Claudius, of forming a harbour with docks and artificial basins. In order to make a good foundation for one of the piers, or sea walls, the great vessel of which we have spoken was sunk as a caisson; the inside was filled with masonry; and on this was erected a tower of great height to serve as a lighthouse, in imitation of the celebrated lighthouse on the island of Pharos in the harbour of Alexandria.

The accommodation, however, afforded by the new port proving inadequate to the requirements of the increasing

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\* Suet. Cal. 15.

† Id. Claud. 38.

‡ Vopiscus in his life of Aurelian gives a letter addressed by the Emperor to the "præfectus annonæ" or "inspector of the markets," in which the following curious passage occurs. After enumerating all that he had done to facilitate the supply of food to the people by improving the navigation of the Tiber, and increasing the number of boats which plied upon the river, he goes on to say: "Nunc tenue est officium, jucundissime Arabiane, elaborare ne meæ dispositiones in irritum veniant. Neque enim populo Romano saturo quicquam potest esse lætius." "It is now an easy task for you, my dearest Arabians, to use your endeavours, that my arrangements do not come to nought. For nothing can be in better humour than the Roman people when their bellies are full." From which it may be inferred that nothing would be in worse humour when their bellies were empty.

commerce of Rome, a new basin was dug by Trajan, and works constructed on a gigantic scale, including not only interminable rows of magazines, and all the conveniences required by a great commercial port, but those buildings which ministered to the luxury of the Roman people, and were looked upon as the inseparable adjuncts of even a second or third-rate city, baths, temples, and an imperial palace with a theatre attached to it. Portus, the new city, increased at the expense of its sister colony of Ostia; the municipality of the latter migrated in great part to the former; new buildings grouped themselves round the imperial palace and the storehouse,\* and every day added to the importance of the town. It continued to be a port up to the time of Constantine. But the course of nature cannot be arrested; no harbour can long exist at the mouth of a river which brings down large quantities of mud, and is continually extending its delta; though the navigation of such a river may be continued by dredging and other artificial means. Portus has shared the fate of Ostia, and its remains are to be sought in the centre of a dreary and unwholesome fen a mile and a half from the sea, while Ostia is removed to the distance of three miles.

It is no part of my plan to enter into architectural details, or to describe the works of man, except as far as they affect the navigation or modify the physical character of the river. The reader, therefore, who wishes to be informed regarding the discoveries which have been made by excavations, and to learn the speculations of archæologists upon them, is referred to the pamphlet of Lanciani, and to the works of the authors whom he mentions as furnishing fuller details, namely, Fea, Nibby, Rasi, and Canina.

In the present day small steamers drawing about four feet of water, and from eighty-five to one hundred and twenty feet in length, and twelve to seventeen feet broad, ply between Rome and Fiumicino at the mouth of the northern branch of the Tiber. Fea, with whom agree Rasi, Nibby, and Canina,

\* Lanciani, who quotes Dollinger, Hippolytus, and Callistus.

considers the Fiumicino arm to have been originally an artificial canal dug by Trajan to connect his port with the Tiber, and calls it Fossa Trajana. As the delta advanced the canal extended itself beyond the limits of the port of Trajan, from which its mouth is now distant a mile and a half. It was deepened by Fontana at the desire of the reigning Pope, and is now the only navigable branch. By means of stakes the channel is narrowed, and the requisite depth of water and velocity of current maintained; but the width is so contracted by this means, that two small vessels can scarcely pass each other. Similar small steamers formerly ascended the river as high as Ponte Felice, about fifty-one and a half English miles above Rome, while large barges went as far as Orte, two miles above the confluence of the Nera, and distant seventy-one miles from the city by the windings of the stream; but now, owing to the state of the river, the steamers ascend only to Scorano near Correse, and the barges to Ponte Felice. The barges are towed by the steamers as far as the latter go, and the remainder of the distance by buffaloes. The steamers draw from three feet three inches to three feet eight inches of water, and have a speed of from eight to ten miles an hour, but owing to the rapidity of the current their progress is extremely slow, and they are now employed exclusively as tugs; few persons caring to encounter the weariness and discomfort of the voyage.

Above Orte the Tiber is navigated only by rafts, which descend the river during the autumn and winter months, and on their arrival at Rome are broken up and sold. The navigation of the upper Tiber presents peculiar difficulties, owing to the great fall of the river and the number of rapids in its course. The subject has engaged the attention of successive Pontiffs, among others of Clement XII., who appointed the engineers, Andrea Chiesa and Bernardo Gambarini, to survey the course of the Tiber, and report upon the feasibility of rendering it navigable from l'onte Nuovo, just below the mouth of the Chiascia to the Nera, a distance of fifty-two English miles and a quarter.

The Tiber is described by them as flowing below Ponte Nuovo in a wide and shallow bed, occasionally encircling islands of small extent. In the neighbourhood of Todi the rapids commence. The river rushes with great force through the narrow gorge of Il Forello, and soon after precipitates itself into the gulf or chaldron known by the name of Inferno, where there is a tradition that a raft was once swallowed up and never reappeared. Emerging thence it descends by a series of rapids known by the names of Infernello, Cacastozza, Molinacci and etc., to its junction with the Chiana. The whole fall of the river is no less than two hundred and sixty-six feet and a half in the course of fifty-two miles and a quarter. The river also is liable to change its course, which increases the difficulty of dealing with it.

The attempt to overcome the difficulties created by the shallowness of the river in one place, and its rapidity in another, would involve, the engineers consider, an enormous expenditure, with the almost certainty of failure. The piling and embankments required to narrow the current of the river and increase its depth would be wholly or partially swept away during great floods, while the locks and dams, which must be constructed at the rapids, would not only be very expensive in the first instance, but liable to be destroyed by the force of the swollen current beating against their walls. They might also be rendered useless by a change in the bed of the river. They suggest, therefore, that, instead of trying to render the river itself navigable, a canal should be formed parallel to its course, and supplied with water from it; the river, where circumstances admit, being used as part of the canal. The report was submitted in the year 1746 to Benedict XII. but was never acted upon; either because the Popes were too poor to bear the expense, or because such a canal, not connecting any large towns, would not be likely to pay. The scheme may, however, be revived and carried out under the new government when the Campagna is cultivated and the canal can be turned to better account.

The estimates of the length of the Tiber differ to the extent of twenty miles. I have adopted that which I consider the most correct; according to which the total length of the river from its source to the sea is two hundred and fifty Roman, or two hundred and thirty-two English miles, and the distance from Rome to Fiumicino twenty-two and a half.

The distance in a direct line from the source of the Tiber on the north to that of the Salto on the south is one hundred and forty miles; and from the source of the Paglia on the west to that of the Nera on the east about seventy-eight. If we take the mean of the greatest and least widths, the basin of the Tiber, or area drained by its tributaries, may be estimated roughly at six thousand five hundred square miles.\* This includes, of course, the minor basins of the Chiascia, the Chiana, the Nera and the Anio.

The colour of the river is owing to the constant falling in and abrasion of the banks in the alluvial valley through which the river flows after quitting the mountains. The fine soil is quickly diffused through the water, and imparts to it its peculiar tinge.

The mud of the Tiber is said not to possess the fertilizing property of the slime of other rivers, which, by enriching the land which they overflow, make some amends for the damage caused by their inundations. But this absence of fertilizing power is only temporary and apparent. The infant river in its rapid descent as a mountain torrent carries with it rocks, gravel, and sand, and when it overflows its banks, covers the fields with a debris which seems to condemn them to perpetual sterility. As the declivity of its channel diminishes, the stones and gravel are left behind and the sand alone is deposited.† But it is not until it arrives in the plains and flows with a sluggish current that the finer particles of earth, and any organic matter it may contain, subside to the

\* The basin of the Tiber is extremely irregular, and more accurate measurements have shown that it exceeds seven thousand square miles.

† If water flows three inches in a second, it will carry clay; if six inches, sand; and if twelve inches, gravel.

bottom during floods, and constitute the rich loam which imparts exuberant fertility to the lower courses and deltas of rivers. The Tiber, as low down as Rome, retains many of the characteristics of a mountain torrent. Even when the river is low, the current is strong; and during floods the commotion of the waters allows nothing to be deposited but the heavier sand, while the fine earth and lighter organic matters are held in suspension and carried onward to the sea. The deposit of the Tiber—for mud it can scarcely be called—consists almost entirely of volcanic sand or minute particles of volcanic minerals derived from the disintegration of the tufa, among which mica is conspicuous, sparkling like diamonds in the sun. It contains no appreciable quantity of organic matter, is wholly free from smell, and in situations where it can dry readily, is not likely to evolve unwholesome gases, or to produce the deleterious effects attributed to it.

If we examine it under a high power of the microscope, we detect, besides the mica, the dark coloured pyroxene or augite, and fragments of amphotene or leucite, sometimes called white garnet, which is found in great abundance in the neighbourhood of Rome, and often used in cheap jewelry. This volcanic sand is very different from pure silicious sand, consisting, as it does, of compound minerals, which, when exposed to the atmosphere, undergo a slow decomposition, and are resolved into the earths which constitute the soil best adapted to the growth of plants. Volcanic soils are proverbially fertile, and, though the impalpable earths already liberated by the chemical decomposition of these volcanic minerals are carried away, as I have said, by the current of the Tiber, the coarse sand will in its turn undergo decomposition in situ, and the Prati and other lands overflowed by the Tiber be eventually benefited by the top dressing they receive.

## WATER OF THE TIBER.

If we look upon the seething waters of the Tiber in a flood, yellow as pea-soup, and apparently of the same consistence, we may be disposed to pity the Romans of the early republic, who for four hundred and forty years had little else to drink. Equally hard may seem the lot of their descendants of the middle ages, who were constrained to return to the water of their turbid stream.\* The aqueducts, which once conveyed whole rivers to what was then the capital of the world, had long since been broken down by the Barbarians or fallen into decay. Rome, reduced to the dimensions of a petty state, and drained of its resources by civil wars and continually recurring calamities, was unable to keep such gigantic structures in repair. The *Piscinæ*, or reservoirs, in which the water deposited its mud, were no longer cleaned out; the conduits were obstructed by calcareous incrustations, and the springs from the distant mountains ceased to flow in their accustomed channels or were wasted by leakage before they reached the town. The water of the Tiber, supplemented by a few small springs and wells, was thus the only resource of the Romans, and was sold through the city in barrels, after it had been allowed to settle for six months, and deposit the impurities it contained.† This state of things continued up to the time of Pope Pius IV., 1559, who repaired the *Aqua Virgo*, now called the *Acqua Vergine*, the aqueduct whose restoration entailed the least expense; and about twenty years later

\* When Rome was invested by the armies of Alaric, the aqueducts were broken down, and the citizens were driven to drink the long-disused water of the muddy Tiber. But this was one of the privations incident to all sieges, and trifling compared to others which they had to endure.

† The mother of Rienzi eked out her gains as a washerwoman by hawking this water through the streets.



Sixtus V., availing himself of the remaining arches of the Aqua Claudia, brought an entirely new source into Rome, the Acqua Felice, so called from his conventual name, Fra Felice.

Yet there were some who preferred to any other the water to which they had so long been used, and attributed to it superior sweetness and health-bestowing qualities. Clement VII., 1523, carried a supply of it with him, by advice of his physician Conti, when he repaired to Marseilles, to celebrate the marriage of his niece Catherine di Medici with the brother of the Dauphin, afterwards Henry II.; and Paul III., 1534, was never without it in his longest tours. Even Gregory XIII., 1573, though he filled the Papal chair after the restoration of the Aqua Virgo, drank the Tiber water constantly up to the time of his death, which occurred in the eighty-fourth year of his age.\*

Cancellieri—as Moroni informs us—in a work entitled “Mercato,” published in 1811, declares that up to that date the Therisians of the convent of Scala, and the Benedictines of the Monastery of Calisto, both situated in the Transtevere,† as well as the Philipppines of the Chiesa Nuova, made use of this water, though they considered it necessary to allow it to settle for a period of six months.

A difference of opinion having arisen as to the wholesomeness of the Tiber, it was analyzed—according to the same Moroni—by Antonio Clementi, afterwards Professor in the University, and pronounced, not only fit to drink, but superior in quality to that of the Thames or Seine.

\* Moroni Dizionario d'erudizione Ecclesiastica. Moroni observes that he had seen this statement in many authors which he had read.

† Before the restoration of the Acqua Paolo, the ancient Aqua Alsietina, by Paul V., 1605, there was no aqueduct on the Transtevere side of the Tiber; but that, after that date, with such a supply of the purest fluid at hand, any one should prefer the water of the Tiber, may appear incomprehensible to those who do not know how clear and sweet that water becomes after being allowed to settle.

The water conveyed to Rome by the aqueducts of the Acqua Vergine, Acqua Felice, and Acqua Paolo exceeds in amount that which is furnished by the canal d' Ourc, the principal source of supply to Paris, a city containing ten times the population of Rome,

Being desirous to learn something about the quality of this water, and to form an opinion as to the time within which it might be drunk, I filled a large flagon with it at a time when it was greatly discoloured by a sudden flood. At the end of five hours, I found that it had deposited all its yellow mud, but still retained a slightly milky hue. I had purposed to filter it, in order to render it perfectly transparent; but being otherwise engaged, and obliged to defer the operation, I was surprised to find that, on the fifth day, inclusive, it had become as clear as crystal, and in no way distinguishable from the water of the Acqua Vergine.

I drank a portion, used another portion for making tea, and found it excellent. A trial of it with soap shewed it to be of a medium degree of hardness. In short, it was very superior to the water with which Londoners are supplied from the Thames. A bottle of it well corked was left at Rome during the summer, to see whether it would undergo fermentation owing to the presence of organic matter, and develop any unpleasant taste or smell. On my return, after an interval of four months, the water was found to be perfectly sweet to the taste, and free from any disagreeable odour.

It appears from this experiment that the impurities held in suspension will be deposited as completely in six days as in six months. It is scarcely necessary to observe that those which are chemically dissolved will not separate after any length of time.

It would seem as if the presence of earthy matters held in suspension tended to deodorise and render innoxious the organic substances contained in water; for the water of all muddy rivers, which have not received the sewage of towns, has the reputation of being both wholesome and pleasant to the taste. The author of the “Attractions of the Nile”\* declares the water of that river to be the sweetest, softest, and most palatable he had ever tasted. “Its thick, muddy, yellow appearance created, indeed, a feeling of aversion, but when

\* Attractions of the Nile, by C. Smith, M.A.

passed through a filterer it came out bright and sparkling." Even when he was away from the filter, and drank direct from the river, no difference of taste, he said, could be perceived.

Similar testimony is given by travellers to the excellence of the water of the Missouri and lower Mississippi, while the muddy water of the Hoogly at Calcutta is declared by the government analyst to be purer than that which Glasgow draws from Loch Catrine, and it is from that source that Calcutta will in future be supplied with water, the impurities, of course, being allowed to subside.\*

But though the water of the Tiber was wholesome, and the supply of it abundant, the labour of fetching it from the river must have been very great, when the Romans dwelt mainly on the hills, and the reservoirs required for purifying it, if purification was thought necessary, must have occupied a considerable space, and entailed a great amount of trouble. Aqueducts, therefore, were constructed to supply the water at a higher level for the convenience of the *Thermæ*, and other public establishments, as well as of private houses. Accordingly we find that as Rome became more populous, and the people more luxurious, the water of each successive aqueduct was taken from a higher source and entered the city at a higher level. The following are the relative heights given by Murray at which the aqueducts successively constructed, entered Rome:

Aqua Appia	121 feet English
Anio Vetus	149 "
Aqua Marcia	173 "
" Tepula	182 "
" Julia	191 "
" Claudia	203 "
Anio Novus	212. "

Such was the quantity of water brought by the aqueducts that, to use the language of Strabo, (*Lib. v. Chap. 8*) whole rivers flowed through the city and the sewers, and thanks to

\* Letter of the Calcutta correspondent of *The Times*, March 25, 1873.

Agrippa, almost every house in Rome was provided with pipes for conveying the water and tanks for storing it.\*

Within the city the bed of the Tiber is artificially contracted in order to gain ground for houses and gardens, or to secure a sufficient depth of water for boats; the houses in some cases being built on arches over the river. Thus, at the Ripetta the stream is not more than one hundred and ninety-seven feet in width when the river is low; and immediately above Ponte Sisto, where it appears to have been most encroached upon, it is narrower still. But at the Ponte Molle its breadth is four-hundred feet; and midway between the bridge and Aqua Acetosa it expands to the width of five-hundred feet, even in the driest season. The average width of the river above the Ponte Molle considerably exceeds that of the Thames at any point beyond the influence of the tide, as at Hampton or Eton, and the volume of water is many times greater. In this part of the Tiber many fine positions for villas might be found overlooking the broad reaches of the river, and with the lofty range of the Apennines for a background. Judicious and tasteful planting would complete the beauty of the view. When Rome under the new government becomes a richer and more prosperous city, and the reputed unhealthiness of the Campagna has been corrected by cultivation and planting, I have no doubt, advantage will be taken of such sites, and the Tiber again present the appearance which it exhibited in the times of Ancient Rome, like that which the banks of the Thames exhibit at the present day.

\* τοσοῦτον δ' ἐστὶ τὸ εἰσαγώγιμον ὕδωρ διὰ τῶν ὑδραγωγείων ὥστε ποταμούς διὰ τῆς πόλεως καὶ τῶν ὑπὸ νόμων ρεῖν ἅπασαν δὲ οἰκίαν σχεδὸν δεξαμενὰς καὶ σίφωνας καὶ κρουνοὺς ἔχειν ἀφθόρους, ὧν πλείστην ἐπιμέλειαν ἐποιήσατο Μάρκος Ἀγρίππας.



## SUPERSTITIONS CONNECTED WITH THE TIBER.

The Tiber, as I have before observed, had no special form of worship, though altars were raised and sacrifices offered to its tributary streams, nor in the earlier period of the history of Rome was any religious observance connected with it.\* But towards the close of the republic, when Rome had become the mistress of the world, new feelings and practices came to be associated with the river of the conquering state. People of every race and creed flocked to the Imperial city, where they enjoyed the freest licence of opinion, and practised their rites, however strange, without molestation.† For it was the

\* The Argei, or images of men formed of bulrushes, which were thrown into the Tiber on the Ides of May, were not intended as offerings to the river, or as a recognition of its divinity. The origin of the custom is uncertain. Two explanations were offered in the time of Ovid: first, that the figures represented old men past the age of sixty, who in barbarous times were cast into the river as burdens on the community. Second, that they were substitutes for the human victims who in a remote period of Italian history were sacrificed to Saturn. The first explanation is rejected by the Poet as absurd; the second may equally be repudiated. For there is no evidence of human sacrifices in the Saturnian times. The Argei were thirty in number, and were thrown from the Pons Publicius, as being the most venerable from its antiquity, and invested with a sacred character. Ovid represents the Tiber as settling the question by telling the story of how the practice originated.—See *Fasti* v. 635.

† It is scarcely necessary to observe that the Christians were not persecuted for introducing new gods, but for denying the ancient deities and denouncing the worship of the established religion. A pagan Roman might be at one and the same time a worshipper of the old established god Jupiter, and of the newly-imported divinity Isis. But when he became a Christian such a compromise was impossible. It was necessary to renounce the religion of the state and to forswear the faith of his ancestors and his family. Social ties were thus dissevered and deadly enmities engendered. Besides, associations, however harmless their ostensible object, and especially secret societies, were regarded with suspicion by the ruling powers, because it was feared that their organization might be abused for political purposes. Now, the Christians formed an associa-

policy of the Romans to tolerate every form of belief which did not interfere with the worship established by law, or appear to be subversive of social order, or dangerous to the government of the day.\* Fresh gods might be introduced provided the old ones were recognised, and the new Divinities were content to take their places, side by side, with the occupants of the existing temples.

Along with their peculiar dogmas and rites the votaries of these foreign religions imported the superstitions connected with the rivers of the East, the Jordan, the Ganges, and the

tion of which nothing was known, except that it worked in darkness. Individuals were thus tempted to denounce their personal enemies as members of an illegal society, and Governors of provinces, like Pliny the younger, however humane, and however free from fanaticism, were compelled to enforce the law against them. That the fears of the authorities were not groundless appears from a modern instance. The late insurrection in Poland was organized and directed by the so-called Agricultural Association, consisting mainly of landed proprietors. The name was intended merely as a screen, and though meetings were occasionally held, at which Agricultural subjects were discussed, the members met also in secret conclave to concert measures for forwarding the national cause.

Other religions, it may be remarked, were proscribed with impartial severity when they did not comply with the conditions on which toleration was granted. Attempts were made both by Augustus and by Tiberius to suppress the worship of Isis, on account of the immoralities of her priests, and in the reign of the latter, the Egyptians, as they were called, were banished from Rome. The priests of a temple of Isis had been agents in a nefarious transaction; the aggrieved party complained to Tiberius, and the emperor ordered the priests to be crucified, the temple to be razed to the ground, and the image of the goddess to be thrown into the Tiber [See the story of Mundus and Paulina in Josephus.—*Ant. Jud.* xviii. 7.] At the same time the followers of Isis were banished from Rome, and her religion appeared to be extinguished for ever. But public feeling was too strong for the government. The mysterious rites of the Egyptian religion seem to have possessed an extraordinary fascination for the Roman mind; the worship of Isis revived, and even spread more widely than before, until it became a theme for the indignant declamation of Juvenal.

• In the reign of Tiberius the Jews also, with far less reason, were expelled from Rome. An individual of that nation had appropriated a large sum of money which had been entrusted to him to be remitted to Jerusalem for the service of the temple, and the whole people were involved in the consequences of his crime. The Jewish youths were draughted into the army, and sent to the most unhealthy quarters of the globe, and the remainder were ordered under the severest penalties to quit the city.—*Suet. Tib.* 36, and *Joseph. Ant. Jud.* xviii 7.

Nile, and as appears from Horace, Juvenal, and Persius, the Chaldæans, the Egyptians, and the Jews, attributed to the Tiber, as to their native streams, the power of insuring against coming evils, and of cleansing from moral as well as physical pollutions, those who bathed in its waters and performed the ceremonies prescribed by their priests.

Among the various forms of religion which prevailed under the Empire, that of the Jews was regarded with the greatest aversion and contempt, while that of Isis attracted the largest number of followers. The Jews were despised for their credulity and hatred for their moroseness. Few were found to embrace so uninviting a religion; nor were the Jews themselves disposed to seek for converts. The worship of Isis, on the other hand, was highly popular. Her temples rose in every quarter of the city, and the priests of the Egyptian goddess seem to have gained an extraordinary ascendancy over the Roman dames.

In the following passage of Juvenal\* we have an account of the strange ceremonies performed, and of the physical discomforts endured by their disciples of the softer sex:

Hybernum fracta glacie descendet in amnem.  
Ter matutino Tiberi mergetur, et ipsis  
Vorticibus timidum caput abluet; unde Superbi  
Totum regis agrum, nuda, ac tremebunda cruentis  
Erepet genibus.—Juv. vi. 521.

It was not for the purpose of hardening their constitutions that the Roman dames, of whom the poet is speaking, broke the ice, and plunged into the Tiber at early dawn; but by direction of the priests of Isis, as part of the ceremony for averting coming misfortunes.

\* The Jews in the age of Juvenal appear to have led a life not unlike the gipsies of modern times. They were, also, like the gipsies, the vulgar fortune-tellers of the city, the Chaldæans, as soothsayers holding the highest rank.

"Qualiacunque voles Judæi somnia vendunt."—vi. 546.

The Jews will sell you any dreams you please, says Juvenal, but the "credat Judæus," by which Horace expresses his contempt for the nation, refers to their religious belief.

For the benefit of the ladies I subjoin a translation of this passage that they may see of what their sex is capable, under the influence of highly-wrought feeling, whether well or ill directed:

"In depth of winter she will break the ice, and descend into the stream. Thrice at early dawn she will plunge into the Tiber, and in its very eddies bathe her shrinking head. Then naked,\* [that is, in her tunic, or as we should say, in her shift] and shivering, on bleeding knees, she will creep across the entire middle of the Proud King's estate."—The Campus Martius, once the property of Tarquinius Superbus.†

The same practice is also referred to by Persius:

Hæc sancte ut poscas, Tiberino in gurgite mergis  
Mane caput bis terque.—II. 15.

Horace, likewise, describes a similar superstition:

"Jupiter ingentes qui das adimisque dolores—"  
Mater ait pueri menses jam quinque cubantis—  
"Frigida si puerum quartana reliquerit, illo  
Mane die quo tu indicis jejunia, nudus  
In Tiberi stabit." Casus medicusve levarit  
Ægrum ex præcipiti, mater delira necabit  
In gelidâ fixum ripa, febrimque reducet.

"Jupiter"—exclaims the mother of a boy  
Now lying ill five long and weary months—  
"Should the cold quartan ague quit my child,  
Upon the morning of the day when thou  
A fast proclaimest, naked he shall stand  
In Tiber's stream." Let Chance, or doctor's skill  
Snatch the sick stripling from the jaws of death,  
The mother—idiot-like will kill her son  
Stuck, like a post, upon the chilly bank,  
And cause the banished fever to return.

In this quotation the address of the mother of the sick boy is, to Jupiter, a Roman god; but the superstitious practice of

\* Thus nudus ara, sere nudus....G. I. 15. "Plough in your tunic, in your tunic sow." The Roman Tunic, though made of wool, corresponded to our shirt.

† This would be equal to the distance from the Porta del Popolo to the Capitol, or from the Corso to Ponte St. Angelo.

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standing naked in the Tiber is evidently of Eastern origin; for it was no part of the religion of the Romans to propitiate the gods, by inflicting physical sufferings on themselves, like the votaries of Baal or of Shiva. Jupiter, above all others, was a self-indulgent god, and indulgent to others, as the word "jovial," derived from his name, would imply; and as long as his divinity was recognised and his rites duly performed, was content that his worshippers should lead an easy, or, if they were so disposed, a voluptuous life.



BRUNN & CO. ROMA

THE BRUNN & CO. PICTURES BASED UPON THE SCENE OF ROMI IN THE TIBER IN 1843

# ANGLING FOR WOOD IN THE TIBER.

In Shakespeare's *Julius Cæsar*, Cassius thus relates how he saved Cæsar from drowning in the Tiber:

For once upon a raw and wintry day,  
The troubled Tiber chafing with her shores,  
Cæsar said to me: "Can'st thou, Cassius, now  
Leap in with me into this angry flood,  
And swim to yonder point." Upon the word,  
Accoutred as I was, I plunged in,  
And bade him follow; so indeed he did.  
The torrent roared, and we did buffet it,  
With lusty sinews throwing it aside  
And stemming it with hearts of controversy.  
But ere he could arrive the point proposed  
Cæsar cried "Help me, Cassius, or I sink."  
I, as Æneas, our great ancestor,  
Did from the flames of Troy upon his back  
The old Anchises bear, so from the waves of Tiber  
Did I the tired Cæsar.—ACT I, SCENE 2.

One of my friends, quoting this passage, observed how inapplicable this description was to the Tiber of the present day, a river so narrow, he observed, that a person might almost leap across it. Such was the impression he had received from the works on Rome which he had read. I showed him the lithograph of the Ponte Molle, from which he could see that the Tiber was not quite so narrow as it has been represented by those whose prejudices are stronger than their eyesight, and whose powers of observation have been so little exercised, that they are incapable of distinguishing between a breadth of one hundred and four hundred feet. I also informed him that, though wind had little effect in ruffling the surface of the river, owing to the height of the banks, yet when swollen by heavy rains, and nearly on a level with the banks, it rolls along an immense body of water, and roars and eddies so as fully to realize the description of Shakespeare. At such times

it would be a matter of difficulty, and even risk, to stem the impetuous current, and avoid the trunks of trees and rafts of underwood which the river is continually bringing down.\*

On these occasions, those who happen to be near the river may witness an amusement or occupation of a novel and characteristic kind; that of angling for the wood, brought down, as I have said, by the floods from the Campagna and the forests of the Apennines. While some in their frail barques stem the violence of the current, and strive to arrest the progress of the trees as they sweep past their boat, others stand on the banks or the bridges, poising in their hands a piece of wood, from which project two or three long and crooked teeth formed by the smaller branches growing out of the trunk from which the piece of wood is cut. This instrument, called in Italian "rampicone," or grapple, is attached to a long piece of rope, which is gathered up in the hands. When a log approaches within striking distance, a cast is made with the "rampicone," but usually, as far as my own observation goes, without success. Either it misses the object at which it is aimed or fails to grasp it with sufficient firmness. The log sails past and pursues its way to the Mediterranean, unless stopped lower down by some more skilful or fortunate angler.

It may seem that such an amusement ought to be wholly free from risk, yet fatal accidents occasionally occur. Some persons are foolish enough to fasten the rope to their wrists, and if they happen to hook a log of more than ordinary dimensions, they are unable either to resist the force with which the current impels it or to free themselves from the rope, and are dragged into the Tiber and drowned. In 1870 two persons perished in this manner.

On these occasions policemen used to be sent by the Papal government to warn the people against the dangerous practice which I have described. Nevertheless, one or more lost their lives every year.

\* A man was drowned, May 21st, 1872, in attempting to swim across the Tiber at Ponte Sisto, in order to escape the gens d'armes.—*Libertà*, May 23rd.

The boats are exposed to greater dangers, and are sometimes overset by the trees with which they come into collision; but those that man them are practised swimmers, and, as far as I can learn, always contrive to escape.

By far the largest harvest is reaped by these boats, and a considerable pile of wood is often collected on the top of the stairs which descend from the Ripetta to the river; but not as may well be supposed, in a condition for immediate use. Indeed, I have sometimes suspected, from the difficulty I found in getting it to burn, that a portion of the wood supplied to me had made a voyage down the Tiber.

The great quantity of wood and débris brought down the Tiber, among which may often be seen portions of the bank kept afloat by the bushes still adhering to them, coupled with the impetuosity of the current during floods, appears to me to be conclusive against the theory which attributes these floods to the damming up of the stream by scirocco winds. For the trees must be uprooted and swept away by torrents swollen by rain or melted snow, and the increased velocity of the river can be due only to the additional quantity of water poured into it from above; since the effect of damming up the stream without increasing its volume would be to render its current more sluggish. This subject, however, will be treated at greater length hereafter.



## INUNDATIONS OF THE TIBER.

The Tiber is remarkable among the rivers of the world for the suddenness of its inundations, the height to which they rise and the devastation which they cause. These visitations have occurred at every period in the annals of the world, and have been chronicled by Roman historians and writers of the middle ages along with the wars and political revolutions of the time. The origin of Rome is associated with an inundation, and an inundation is said to have consummated the ruin of the city.

Thirty-six great floods of the Tiber are enumerated by an Italian writer, Jacomo Castiglione, from the birth of Romulus to the year 1598. The most remarkable of these I will notice, describing at greater length the inundation which happened in the reign of Tiberius, and those of the years 1530, 1557, 1598. Copious details of these, illustrating the manners, feelings and political sentiments of the times, are given by writers who lived not long after the age in which they occurred.

Several are mentioned by Livy, beginning with the year 214 before Christ. The most destructive appear to have been those which occurred in that year, and in 192 A.C.

For we read:

"Twice in that year there were great rains, and the Tiber inundated the fields, causing the downfall of many buildings and great loss of life among men and cattle."\*

"The Tiber inundating the city with more destructive violence than before, overthrew two bridges and many build-

\* "Aquæ magnæ bis in eo anno fuerunt, Tiberisque agros inundavit cum magna strage tectorum pecorumque, et hominum pernicie."—Lib. XXIV. 9, A.C. 214.

## INUNDATIONS OF THE TIBER.

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ings, especially about the Porta Flumentana. In the fields, which were inundated in every direction, cattle were swept away, and farm houses levelled with the ground."\*

To this we may add:

"There were great rains in that year, and twelve times the Tiber inundated the Campus Martius," [or region extending from the river to the Corso] and the level parts of the city.†

\* "Tiberis infestiore quam priore impetu illatus urbi, duo pontes, ædificia multa, maxime circa Portam Flumentanam evertit...In agris passim inundatis pecua ablata, villarum strages facta est."—Lib. XXXV. 21, A.C. 192.

† "Aquæ ingentes in eo anno fuerunt. Tiberis duodecies Campum Martium planaue urbis inundavit."—Lib. XXXVIII. 28, A.C. 189.

## INUNDATION OF 700 U.C.

In the year 700 U.C. there was a great inundation, of which a brief account is given by Cicero in a letter to his brother Quintus: "At Rome, and especially on the Appian way, as far as the temple of Mars, there has been an extraordinary inundation. The walk in the pleasure-grounds of Crassipes was swept away, as well as very many gardens and booths [for the sale of merchandise]. The flood rose to a great height, and reached as far as the public swimming bath."\*

Cicero, instead of giving us further particulars which would have enabled us to identify the position of the Piscina Publica and to estimate the extent of the flood, goes on to moralise on the visitation. He quotes the lines of Homer† in

\* "Romæ et maxime Appia ad Martis mira alluvies. Crassipedis ambulatio ablata, horti, tabernæ plurimæ; magna vis aquæ usque ad Piscinam publicam."—Cic. Epp. III. 7.

† All that is known about the position of the Piscina Publica is that it was somewhere between the Vicus Alexandri and the Circus Maximus, probably nearer to the latter. For Ammianus Marcellinus tells us that the Vatican obelisk on its way from the Vicus Alexandri, where it was landed, to the Circus Maximus, passed near to the Piscina Publica.

‡ I make no apology for transcribing entire this fine passage:

Ὡς δ' ὑπὸ λαίλαπι πᾶσα κελαινὴ βέθριθε χθών  
Ἡματ' ὀπωρινῷ, ὅτε λαβρότατον χεῖι ὕδωρ  
Ζεὺς, ὅτε δὴ τ' ἀνδρῆσσι κοτεσσάμενος χαλεπήνῃ,  
Ὅι βίη ἐν ἀγορῇ σκολιῷς κρίνωσι θέμιστας,  
Ἐκ δὲ δίκην ἐλάσῃσι, θεῶν ὅπιν οὐκ ἀλέγουτες.  
Τῶν δὲ τε πάντες μὲν ποταμοὶ πλήθουσι ρέοντες,  
Πολλὰς δὲ κλιτῦς τότ' ἀποτμήγουσι χυράδραι,  
Ἐς δ' ἄλλα πορφυρέην μεγάλη στενάχουσι ρίουςαι  
Ἐξ ὀρέων ἐπὶ κάρ' μινύθει δὲ τε ἔργ' ἀνθρώπων.—II. XVI. 384—392.

Tis thus in Autumn Jove his fury pours,  
And earth is laden with incessant showers.  
When guilty mortals break th' eternal laws,  
Or judges bribed betray the righteous cause,

which violent rains and floods are attributed to the anger of Jupiter at the perversion of justice by unprincipled men, and connects the inundation of the Tiber with the acquittal of the notorious Gabinius, who had been brought to trial for malversion and corruption in his government.

The "tabernæ" here mentioned were booths or sheds, in which articles of every description were exposed for sale. The shops of the Romans were of two kinds, those which were situated in the basement story of larger buildings, and were let to strangers or sometimes occupied by the master of the house himself, and temporary sheds attached to the side of houses and projecting into the streets. The latter being built of wood, and lightly put together, were liable to be swept away by every flood. As they were a nuisance to the foot passengers, narrowing, as Martial expresses it, the "via" to a "semita," the "road" to a "foot-path," and often compelling the Prætor himself to walk in the mire,\* their destruction was doubtless regarded with complacency by all but their owners.

An Italian translator of Cicero, Antonio Cesari, absurdly renders "tabernæ," "taverns," as if Father Tiber had been a member of the temperance society, and had singled out the taverns from all other buildings for destruction.

Some other details of this inundation are given by Dion Cassius, who, though he lived more than two hundred years

From their deep beds he bids the rivers rise,  
And opens all the floodgates of the skies,  
Th' impetuous torrents from their hills obey;  
Whole fields are drowned and mountains swept away.  
Loud roars the torrent till it meets the main,  
And trembling man sees all his labour vain.—POPE.

\* Nec Prætor medio cogitur ire luto.—MART. VII. 61.

This line is from an Epigram in which Martial, who was a great flatterer of the Emperor Domitian, praises him for having caused these sheds to be removed, and details all their inconveniences. After complaining that the costermongers had monopolised the whole of the city, and enumerating the various articles which they sold, he concludes with

Nunc Roma est; nuper magna taberna fuit.  
Now it is Rome indeed. Just now 'twas one great shop.

after the time of its occurrence, may be considered a trustworthy authority; for he was in the habit of consulting original documents, and displayed judgment and discrimination in the use of them. Dion, like Cicero, is disposed to look upon the flood as a special visitation of Providence: "ἐκ παρασκευῆς δαιμονίου τινός," denoting the wrath of the gods at the misdeeds of Gabinius, who had procured his acquittal by a lavish distribution of bribes.

The river, he tell us, covered not only the lower parts of the city but portions of the high ground. It rose so suddenly that many persons were surprised in the streets, and drowned, while others, who had succeeded in reaching the upper chambers of their houses, escaped immediate death only to perish by the subsidence of the foundations and the collapse of the buildings.

An observation which he makes on this occasion does not appear to have been noticed or explained by any archæologist. "The streets," he says, "remained so long under water that the houses, being built of brick, became thoroughly soaked and fell to the ground, and all the beasts of burden perished.

We read, also in Tacitus that the foundations of the *insulæ*, or detached houses, or blocks of houses, were sapped by a flood which occurred in the reign of Otho. It would appear, therefore, that sun-dried bricks were used, wholly or partially, in the construction of many houses. It may be suggested that the fall of the houses was owing to the subsidence of the ground; but Dio Cassius tells us expressly that the houses fell *because* they were built of brick.\* The "*insulæ*" were usually let out in lodgings, and though more lofty, were, as appears from Vitruvius, II. 8, more lightly built than the "*domus*." It is not unlikely, therefore, that economy would be consulted in the choice of the material. It is impossible, except from the flimsiness of their construction and the bad quality of their materials, to explain the

\* Ἐκ πλίνθων γὰρ συνοικοδομημέναι ἦσαν, διάβροχοι τε ἰγίνοντο καὶ κατερράγησαν.—Lib. XXXIX, 61, p. 323.

wholesale destruction of buildings, especially of farm houses, which is recorded by the Roman historians to have taken place whenever an inundation occurred. If we turn to Vitruvius, we see why these consequences were likely to result from the Roman mode of construction. Speaking of the construction of the *insulæ*, or many-storeyed houses, he uses the words\*: "But brick walls a foot and a half thick—the maximum allowed by law—do not admit of being carried higher than one storey." He then goes on to describe the material to be used for the upper storeys, stone and terra cotta. The style of Vitruvius is obscure, and the word *sustinere* is employed in an unusual sense; but the comparison of one part with another shews that by "*lateres*" he understands crude or sun-dried bricks—for he distinguishes "*lateritii*" from "*testacei*"—and that sun-dried bricks constituted the material of the lower storey. It is not surprising, therefore, that buildings so constructed should give way after having been some days under water.

That Vitruvius uses "*lateres*" in the sense of sun-dried bricks appears also from book II. chap. 3, where we find a detailed account of the precautions which he recommends to be observed in their manufacture. They are not to be made of clay containing too much sand or gravel, because they would, he says, be more likely to crumble to pieces, when exposed to long continued rain. They should be made during the spring and autumn, when they can be gradually and uniformly dried. For the heat of summer would cover the outside with a hardened crust, which would be cracked, as the interior dried and shrunk, and thus the strength of the brick would be impaired. He recommends that they should be kept for two years in order to insure their perfect dryness, and quotes with approbation the municipal regulations of Utica, which forbade any bricks to be used in the construction of houses that were less than five years old.

Not a word is said about the burning of bricks, nor could

\* "*Lateritii vero (parietes) sesquipedali crassitudine non possunt plus quam unam sustinere contignationem.*"—II. 8.

it be gathered from the article that such a thing as a burnt brick was known to the Romans.

But if crude bricks were used to such an extent by the Romans, why do we find no traces of them in the ruins of ancient structures. Perhaps public buildings intended to endure for ages were constructed of more durable materials; perhaps, as has been suggested, the crude bricks in the course of ages may have melted away. A Signore Scamosse suggests an explanation, which is quoted only to be ridiculed by the editor of Vitruvius: that, owing to the numerous fires from which Rome had suffered, the *terra cruda* had become *terra cotta*.

Of the consequences of building with sun-dried bricks we have an illustration in the present century. During the great flood of the Loire, which happened in the year 1859, owing to the disruption of the dikes, there was an extensive downfall of buildings from a similar cause. The Loire, like all rivers that have been embanked for ages, flows in many places above the level of the adjoining country, and when it burst its banks, it laid the fields under water to an extent in one place of twenty miles. Owing to the relative depression of the country, the water remained a long time on the ground, and the consequence was, that great numbers of houses which were built of unburnt brick, or of wood and mud, melted away, and the whole structure fell to the ground.

Everyone will remember the allusion of Horace to the great flood in his time, which destroyed the temple of Vesta, and led people to expect a return of the universal deluge. But in Tacitus we have an account of a remarkable inundation, which occurred in the reign of Tiberius, and as the details are interesting, and illustrate the manners and feelings of the time, I will give the description entire, and in the words of the author:

"Swollen by incessant rains, the river had inundated all the level parts of the city, and when it retired within its bed, it carried with it the wrecks of buildings which it had overthrown, and the bodies of those that were drowned. It was proposed to consult the Sibylline books; but Tiberius objected,

from his inveterate habit of shrouding in mystery all things human and divine; and to Ateius Capito and Lucius Aurruntius was assigned the task of keeping the river within bounds."

After some time these commissioners brought forward in the senate a plan for moderating its inundations, by turning into new channels the rivers and lakes by which its waters are swelled.

No sooner, however, did the municipal towns situated on its tributaries learn what was going on, than they sent deputations to protest against the scheme. The people of Florence intreated that the Clanis might not be turned into their own unruly torrent, and thus bring destruction on their town. In a similar strain, the people of Terni maintained: 'That the most fertile lands in Italy would go to rack and ruin, if the Nar'—for this also was in contemplation—'were cut up into a multitude of canals, and allowed to saturate or overflow the fields.' Nor did the people of Reate preserve silence. They objected to the Veline lake being blocked up, where it discharges itself into the Nar. 'It would burst, they feared, into the neighbouring fields.' 'Nature,' they observed, 'had best consulted the interests of man by assigning to rivers their mouths and their courses, their termination as well as their origin. Some consideration, also, should be shown for the religious rites of the associated states, which had dedicated to their ancestral rivers their peculiar sacrifices, their altars and their groves. Nay, father Tiber himself would be unwilling to be bereft of his affluent streams, and to flow henceforward with diminished pride.'\*

It is curious to observe, as illustrating the comparative influence of sentimental and material considerations in ancient and modern times, that, while so much was thought of hurting the feelings of father Tiber, not a word was said about the injury which the navigation would sustain by lessening the volume of water in the river.

The result was that, partly owing to the prayers of the colonists, partly to superstitious scruples, as Tacitus irreverently

\* Tacitus, Ann. Lib. I. 79.



calls them, and partly, and perhaps principally, to engineering difficulties, this particular scheme was abandoned. But five conservators of senatorial rank were appointed, to whom was assigned the impossible task of regulating the volume of water in the river, so that there might be no deficiency in summer and no injurious excess in winter.\*

But, as might have been expected, man was impotent against nature, and father Tiber revenged himself for the attempts made to control him, by continuing to lay waste the city and the country. The same historian records an inundation in the reign of the Emperor Otho still more destructive than the one above mentioned. "Rising to an immense height the river carried away the Sublician bridge, and covered not only the low lying and level parts of the city, but places which were thought to be beyond the reach of such disasters. So sudden was the rise of the Tiber that many were swept away in public places, and the escape of many who happened to be in the 'tabernæ,' or one-storeyed shops, was cut off. The foundations of the 'insulæ' (or detached buildings, usually let out in lodgings) were sapped by the water, and, when the river subsided, they fell to the ground."†

In the country the devastation was equally great. "For twenty miles above Rome," as Suetonius informs us, "the Flaminian way was obstructed, and the march of the army of Otho impeded, by the ruins of buildings which had been overthrown by the flood."‡

In the reign of the Emperor Trajan there was another great flood recorded by Pliny the younger, Ep. VIII. 7, to which reference will hereafter be made.

And in most of the subsequent reigns there were inundations of greater or less extent, and more or less destructive, culminating in the great flood in the time of Valentinian and Valens, A.D. 371, recorded by Ammianus Marcellinus.

I will close the series of inundations in ancient times by

\* Dio Cassius LVII. 3.

† Tacitus, Hist. I. 86.

‡ Suet. Otho. 8.

transcribing the description of this flood by the last-mentioned historian:

"In consequence of excessive rains the Tiber overflowed the banks, and spreading itself so as to lose the appearance of a river, covered almost every spot with its waters. Thus, while the other quarters of the city, which lie at a low level, presented the aspect of a lake, the hills alone, and a few elevated points that rose like islands above the watery waste, were relieved from immediate fear. As, owing to the extent of the flood, nobody was able to leave his house, and there was danger lest many should perish from starvation; provisions in abundance, by means of boats and skiffs, were supplied [to all]. But, when the rainy weather abated, and the river which had burst its bounds returned to its accustomed channel, all fear was banished, and no further inconvenience was apprehended."\*

In this extract the classical scholar will remark the barbarism, and awkwardness of the style, which renders a paraphrase necessary to make the meaning clear; and the general reader will observe how little effect the works executed by the "Conservators of the Tiber" had in preventing, or even moderating, the inundations of the river. Yet there are engineers in the present day who think that, by employing the same means which so signally failed in ancient times, they can succeed on confining the river within its banks.

\* Tiberis.... effusione imbrium exuberans nimia, et supra amnis speciem pensus, omnia paene contexit, et stagnantibus civitatis residuis membris, quae tenduntur in planitiem molliorem, montes soli, et quicquid insularum celsius eminebat a praesenti metu defendebatur; et ne multi inedia contabescerent, undarum magnitudine nusquam progredi permittente, lembis et scaphis copia suggerebatur abundè ciborum. At vero, ubi tempestas mollivit, et flumen retinaculis ruplis rediit ad solitum cursum, absterso metu nihil postea molestum expectabatur XXXIX. [near the end]."



## INUNDATIONS IN MODERN TIMES.

Many inundations are recorded by writers of the middle ages, the most remarkable of which were those of 555, 589, 725, 778, 1476, 1530, 1557, and 1598.

The account of the flood in 555, given by Paulus Diaconus, may be rejected as altogether fabulous. He describes the river as flowing over the walls of Rome, and mentions a dragon, or sea monster of enormous size, which passed through the city and descended to the sea. This monster appears to have availed itself of the opportunity afforded by the flood to pay a flying visit to Rome, and to inspect its curiosities. All the accounts of this age are tinctured with fable, and Paul the Deacon seems to have been of a peculiarly credulous disposition.

In November of 589, the year before the Pontificate of Gregory the Great, occurred an inundation which is said by the writers of those times to have consummated the ruin of the city.

In the year 725 there was a flood which lasted for seven days, and persons sailed from the Ponte Molle to the steps of St. Peter's in boats of no small size. This was the old St. Peter's. The approach to the new has been considerably raised since that time.

In the year 778 an inundation threw down the Flaminian gate, and carried away the wooden portion of the Sublician bridge. The stone piers were removed to make cannon-balls in the fifteenth century.

In 1476 the river rose so high that a second deluge, like that of Noah, was anticipated. On this occasion the following verses were composed :

Crevit ad hoc signum transcendens limina Tybris  
Octava Iani, quæ memoranda dies.  
Territa Roma : Noe redeunt jam tempora, dixit,  
Diluvio atque iterum corruebat omne genus.

## INUNDATIONS IN MODERN TIMES.

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We come now to three of the most remarkable inundations of modern times, those of 1530, 1557, and 1598. Of these we possess full and authentic details. Printing had been invented ninety years before the first, and the particulars are given by persons who lived at the time, or derived their information from contemporary authorities. The consternation and devastation caused by the first inundation of the three, which rose seven feet higher than that of 1870, may be gathered from the inscription\* on the tablet affixed to the walls of the convent of the Minerva :

To this point the Tiber rose, and now all Rome would have been overthrown  
Had not the Virgin brought it speedy aid.

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\* Huc Tiber ascendit, jamque obruta tota fuisset  
Roma, nisi huc celerem Virgo tulisset opem.

## INUNDATION OF 1530.

The hordes led by the Constable de Bourbon to the sack of Rome had long evacuated the Eternal City, and Clement VII. was recovered from the effects of his six months' imprisonment in the castle of St. Angelo. The position of the contending parties had undergone a change, and brighter prospects appeared to be opening before the Pope. "But his joy was destined soon to be turned into the deepest sorrow, by reason of a calamity which in the present year burst upon the down-trodden city of Rome; for, while scarcely beginning to breathe after the heaviest misfortunes, it found itself plunged into adversity no less gloomy than before."\*

"Clement had gone to Ostia for recreation, when lo! the floodgates of heaven were opened, and there fell during several days a rain so heavy and continuous that all the rivers in those parts, and especially the Tiber, were swollen above measure, and overflowed their banks." So sudden was the rise of the water that many persons were unable to escape, and bridges with the strongest buildings were in a few hours overwhelmed and washed away. All the warehouses, shops, and underground magazines, were invaded by the flood, and countless merchandise and cattle were destroyed. Never before had such losses been caused by the rise of the Tiber, so that the damage was believed to be no less than that which had been sustained at the sack of Rome.†

The Pope having gone, as I said, to Ostia, was imprisoned by the waters. The whole country was like a sea, communication was cut off, and the supply of provisions began to fail. As it was uncertain how long the inundation might last, Clement decided to return to Rome. In those times the Popes did not

\* Muratori, *Annali d'Italia*, Era vulgare. Anno MDXXX.

† Muratori, *Annali d'Italia*.

travel in carriages,\* nor was the same provision made for their personal security as in the present day. Clement and his suite had no choice but to mount their horses, and pick their way, as best they could, along the flooded roads. With great risk both to himself and the rest of the party, the water, as they rode, being up to the breasts of their horses, the Pope succeeded in reaching the city. Here he found all the bridges either broken down by the force of the current—as was the case with the Ponte Sisto—or covered by the waters, so that he was unable to reach the Vatican, as he desired. The castle of St. Angelo was equally inaccessible, and the palace of the Quirinal was not then in existence,† so that he was fain to take refuge at St. Agatha on Monte Cavallo, until the waters should return to their accustomed bed.‡

Meanwhile, on the day preceding the night when the flood attained its greatest height, the celebrated Benvenuto Cellini was occupied in his studio with a work of art, the great golden button for the Papal cope,§ the most famous, after the chalice, of all his productions. The rush of waters came, and in a short time his house and studio were surrounded, though not to an unfordable depth. For some hours, during which the inundation appears not to have varied much in height, he remained undecided what to do. He had to provide not only for his own safety and the preservation of the work of art, which was now approaching completion, but for the security of the Papal jewels, which had been intrusted to him by Clement VII. to be reset. Towards evening the river began to increase again, and, uncertain how high it might rise

\* Clement VIII., 1598, was conveyed in a litter from Ferrara to Bologna. "*Giaconius Vitæ Pontificum*."

† The present edifice was begun by Gregory XII. in 1574.

‡ Muratori, *Annali d'Italia*.

§ This so-called button is as large as a small plate, and therefore affords plenty of room for artistic devices. Under the Papal government it used to be brought out with the diadem in legal form, at the commencement of the Passover, on Christmas-day, and St. Peter's, when the Pope himself chants mass.—Note to translation of *Memoirs of Benvenuto Cellini*, by Roscoe.

during the night, he resolved to make his escape. "Making the preservation of my life my first care, and my honour my next,\* I put all the jewels," says Cellini, "in my pocket, left my work in gold under the care of my journeymen, and, taking off my shoes and stockings, went out at a back window, and waded through the water, as well as I could, until I reached Monte Cavallo."

As the night closed in after the escape of Cellini, and it was apparent to every eye that the Tiber continued to rise, "the City," says Bonini, "was given up for lost; for the current did not cease to batter and overthrow the best inhabited and most considerable houses in the city; such as was that in the Strada Julia belonging to Guilano Cesi." A large factory was undermined, and fell to the ground, burying all the people and animals it contained, and the church of St. Bartolommeo, in the island of the Tiber, as well as the Palazzo Gaetani, was completely wrecked.† "The silence by which the great expressed their consternation was broken only by the groans and shrill cries of the common people, who implored the succour which none were able to afford; for the city had been so impoverished by the sack three years previously, that it did not possess the ordinary appliances reserved for such emergencies, or any means of relieving the poorer classes imprisoned by the waters, and in danger of being drowned, or of perishing by starvation.‡

The next morning, however, the fears of the people were relieved; for the river began to subside, and in three or four days had retired within its bed. But, though the waters retired, "the putrid matters left behind in so many underground places, and the stench which arose therefrom, drew

\* This seems a strange avowal in one who was so ready to wipe out an insult, real or supposed, with the blood of the offender. Contrast Shakespeare:

Mine honour is my life; both grow in one.  
Take honour from me and my life is done.—Richard II.

† *Litteræ Principum*, t. e. *Littera ultima*. Quoted by Moroni in his *Dizionario d' erudizione Ecclesiastica*.

‡ Bonini, "Il Tevere incatenato."

after them a great pestilence, in other words, evil upon evil."\*

As soon as his workshop was accessible, Benvenuto Cellini returned, and "finished," he says, "my work with the help of God, and by my own industry, so happily, that it was looked upon as the most exquisite performance of the kind that had ever been seen at Rome."†

Bonini thus concludes, describing the popular feeling and superstitions of the time: "The outspoken tongues of those days declared that the Tiber had borne in mind the past outrages inflicted on its city, and was enraged at seeing that Charles V. was on his way to the city of Bologna to receive the crown of king of the Romans from that Pontiff whom his armies had kept in the darkness of a dungeon. It foresaw, besides, they said, that the journey of Cæsar could not fail to be prejudicial to the liberties of the Italian republics."

"Such were the conceits of men justly irritated by the calamities they had endured."‡

The most extraordinary circumstance connected with this inundation, is the delusion of the writers of the following century with regard to the weather which preceded the inundation, and the testimony of many of these writers to the absence of rain, and, as far as we can gather, of wind. Muratori, we have seen, speaks of violent rains during several successive days. Bonini, on the other hand, informs us that there was nothing in the state of the weather to lead the Romans to expect a flood. Neither Bonini nor Muratori

\* Muratori, "*Annali d' Italia*."

† *Memoirs of Benvenuto Cellini*.—Roscoe's translation. These memoirs give us a very vivid picture of the manners of the time. In the present day an artist is usually a man of peace; but in those times the meekest men were often driven to fight, and Cellini, fiery in temper and prone to take offence, was par excellence a fighter in a fighting age. He had "slain his man," received absolution from the Pope for the homicide, and was always ready to commit another. The best trait in his character is his frankness. His vanity is often amusing, though it may seem to be in some measure justified by his talents and success.

‡ The Tiber should have wreaked his fury upon the invading Germans, not upon the innocent victims of the assault.

quotes contemporary authority; but we may accept the account of Muratori as the more probable of the two, especially as Bonini loves a miracle, and is always disposed to dispense with natural causes.\*

At the castle of St. Angelo there used to be a slab fixed against a lofty wall marking the height to which the inundation of 1530 rose, and bearing this inscription:

MEMORIÆ  
INUSITATÆ AUCTUS TIBERIS  
AMNIS AD HOC SIGNUM  
QUO ROMA SERENO TEMPORE FACTA EST  
TOTA NAVIGABILIS  
VIII. IDUS OCTOBRIS MDXXX.  
CLEMENTE VII. PONT. MAX. ANNO VII.  
GUIDO MEDICES ARCIS  
PRÆF. POSUIT.†

If "sereno tempore" means merely that the day on which the flood occurred was fine and calm, the circumstances, so far from being miraculous, is what we might expect, and what I have usually observed. When a long spell of wet weather culminates in a great fall of rain, the following day is generally fine and calm, and as the flood occasioned by the rain takes from twenty-four to thirty hours to descend the Tiber to Rome, it will most frequently happen that the day is calm and sunshiny, when the river is at its height. If the words mean that for several days there had been little or no rain at Rome, the fact

\* In Ranke's History of the Popes there is no mention of this inundation. The pedantic Germans seem to think that History should be confined to war and diplomacy, and that the works of God and the great phenomena of Nature are unworthy of notice, even though the life of the potentate, whose history they are writing, may have been endangered by storm or flood. Livy, Tacitus, Dion Cassius and others, had a juster idea of the province of History, and they always have a chapter devoted to storms, floods, and other remarkable phenomena in the Natural World.

† Why this slab was removed it is impossible to conjecture. The indifference of the Romans to everything but Art may, perhaps, have rendered them careless about the preservation of a monument of a great phenomenon of Nature.

was wonderful, if it was a fact; but as there can be no effect without a cause, and miracles are rejected in the present day, we must seek for some other explanation of the phenomenon. The popular notion of the river being dammed up by a sirocco wind is inapplicable in this case; for none of the writers who describe the flood make any mention of gales, and on the eighth of October there could have been no great accumulation of snow on the Apennines. We should be driven, therefore, to the conclusion, if we adopt the account of Bonini, that for one or more days there had been violent storms among the Apennines. Bonini, indeed, tells us that "no inundations had been observed by which the catastrophe could have been foreseen; but the unscientific are always inaccurate observers, —for 'how to observe,' is itself a science—and the superstitious prefer to call in the aid of supernatural agencies. Doubtless, a meteorologist would have discerned in the clouds which lowered over the Apennines, and the thunder which growled in the distance, unmistakeable indications of violent tempests which were discharging themselves over the valleys drained by the principal tributaries of the Tiber."

## INUNDATION OF 1557.

"The Tiber, which is wont to emulate the glories of distinguished men, and itself retains something of the Roman pride, did not fail in the year 1557 and fourteenth of September, to appear not only as the triumphant master, but as the tyrant of Rome." Such are the words in which Bonini introduces a short account of the great inundation of 1557. "Yet may we not rather, he continues, look upon the river as the righteous avenger of so holy a pontiff on his ungrateful people." He then goes on to describe the exertions of Paul IV. to relieve the public distress, how by his voice, and by his example, he animated his subordinates, and made them fly through every region of the City to furnish provisions in abundance to all that were in need.\* But the calamities brought upon the City by the war with Spain, in which the Pope had rashly engaged; the unsparing severity with which he enforced his reforms, and, above all, the restoration of the inquisition with all its cruelties, had so alienated the affections of his subjects, that after his death the people rose, and in their fury mutilated his statue, attacked the inquisition, and ill-treated the officials, and finally tore down every memorial of him, among others, the tablets which he had caused to be affixed in memory of the flood.

This inundation is remarkable, not only because it is the highest but one of which we have any measurement, but

\* Paul IV. may have deserved all the praise which is bestowed upon him for his conduct on this occasion; but Bononi's account both of men and things must be received with great distrust. He was inclined by his taste and disposition to use high-flown language, and to draw upon his imagination for his facts; and he was constrained by his official position to make flattering mention of all the Popes in turn. As they pass in review before him in connexion with the inundations which occurred in their pontificates, each is dismissed with more or less of praise. Even Alexander VI. is in his eyes an exemplary Pontiff. If he spoke from his heart, the other Popes must have appeared to him like angels of light.

## INUNDATION OF 1557.

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because it occurred at a season, September fifteenth, when the snows had disappeared from all but a few isolated peaks of the Apennines; showing how groundless is the popular notion that the floods of the Tiber are caused exclusively by the melting of the snows.

Copious details may be found in the work of Bacci, who lived at the time, and who wrote a description of the flood itself, and of the atmospheric conditions by which it was preceded. According to this writer, the spring of 1557 was serene with northerly winds, and the summer dry. But in the month of May a peculiar condition of atmosphere began to prevail. A haze brooded over the landscape, and the air appeared to be loaded with humid and unwholesome vapours. Numbers were attacked with fevers, which either carried them off at once, or left them in a state of prostration which made them easy victims to other complaints. This state of things continued until the middle of September, when the humid vapours appeared to be precipitated in the form of rains of unusual violence, which, commencing in Sicily and the south-east of France, extended themselves over the whole of Italy. The rain descended in sheets from the clouds, so that every little rivulet became an impetuous torrent and an agent of destruction. All Ravenna was submerged by the torrent of the Montone, and the castle of la Strada was laid in ruins by a small stream which passes close beside it. But the Arno and the Tiber, being the two largest rivers, rose to the greatest height, and caused the most wide-spread destruction. At Florence it was calculated that, without taking into account the damage done in the environs, the loss sustained within the precincts of the town by the carrying away of bridges, the downfall of houses, and the spoiling of articles of merchandise and food, was equal to the expense of building another City. The Tiber laid waste the country almost from its source, sweeping away bridges and mills, and everything which it encountered in its course, and increasing in height and fury, as each successive tributary discharged its swollen torrent into the surging mass. The Nera poured down a flood which



rivalled in volume that of the Tiber itself, and when the two rivers met, the Campagna presented the appearance of a raging sea, which bore down upon Rome and threatened to sweep it bodily away. Luckily it was broad daylight before the river overflowed its banks, and the note of alarm had already been sounded, so that a considerable portion of the moveable property was saved. But the time for removal was short; the Tiber rushed with great force into the streets, and in the course of a few hours the whole of Rome, with the exception of the hills, was navigable for boats. Nor did the water cease to rise until it had covered the site of the Piazza di Spagna, and washed the spot where now commences the steps of the ascent to the Trinità dei Monti.\*

"A fearful and a piteous spectacle it was—to use the words of the writer—to behold so great a city submerged as in a sea, and everything floating about in confusion; articles of clothing, eatables, merchandise, and entire herds of cattle; without speaking of diverse accidents to individuals, of whom some, caught unexpectedly by the waters, took refuge in trees, others found themselves seated in a wretched little building in the country, in imminent danger of being buried by its downfall, or of perishing by hunger; while others attempted to save themselves through the windows in boats, or waited for some one to present them with a loaf of bread on the point of a pike. Many also there must have been, of whose fate nothing certain is known, who were buried under ruins, or drowned, or perished in various ways." This inundation was not only the highest recorded, with one exception, but lasted the longest, the City being under water for the space of four days. From the amount of suffering caused by the late flood we may conceive the misery which must have been occasioned among the poorer classes by an inundation which rose as much above the inundation of 1870 as that was above an ordinary flood into the Ripetta. We have seen that Paul used every exertion to lighten the calamity which had fallen

\* The flight of steps ascending to the Trinità dei Monti was the work of Sixtus V.

on the City. But the same facilities which we now possess for relieving distress did not exist in those days, and the Jews of the Ghetto, then as now, the principal sufferers, would probably have received less attention than the rest, even if they were not looked upon as a race accursed of heaven, and deserving of all that they endured. The stones recording the flood, placed by order of the Pope, were destroyed, as I have said, along with his other monuments by the infuriated populace. It is for this reason that the date of 1557 is omitted in the scale of heights at the corner house in the Via di Ripetta. After some time the Dominican monks of the convent of the Minerva, who naturally cherished the memory of Paul, as a member of their order, and an ardent assertor of their principles, caused the present tablet to be affixed on the outside wall, and inscribed with the following wretched verse:

Huc Tiber ascendit Paulus dum Quartus in anno  
Terno ejus rector maximus orbis erat.

To this point the Tiber rose whilst Paul the fourth  
In his third year was greatest ruler of the globe.

## PIUS V. AND THE TIBER, 66—72.

In Bonini we meet with the following strange account. During an inundation which occurred in the Pontificate of Pius V. the Pope took an Agnus Dei (a waxen image impressed with the figure of a lamb, and consecrated by the Pope, to be distributed to the faithful) and directed an Archbishop, one of his intimate friends, to cast it into the Tiber, where the swell of the river was greatest. "When this had been done, in a moment the river bowed its head, and with rapid strides abandoned the city, and hastened, like a guilty person, to plunge into the waves of the Tyrrhenian sea." "The man," Bonini adds, "that could subdue the pride of the Tiber was able to accomplish even greater things." This refers to the part which the Pope took against the Turks, and to the victory of Lepanto. The object nearest to the heart of Pius was to humble the pride of the Turks, and secure Christendom against their attacks. By unwearied exertions he succeeded in infusing courage unto the Christian Princes, and formed a league of the Empire, the Venetians, and the States of the Church, to arrest the progress of the Infidels. The efforts of the Pope were crowned with success; the fleet of the allies, commanded by Don John of Austria, obtained a signal victory over the Turks, and the tide of invasion began from that time to ebb.\* The victory of Pius over the Turks

\* The Turks at that time had expelled the knights of St. John from Rhodes, had defeated and slain the last king of Hungary of the native line, and even laid siege to Vienna. They hung like a cloud over Europe, and though occasionally worsted, they were strong enough in 1683 to besiege Vienna for the second time, on which occasion the city was relieved by John Sobiesky. What a change in the relative strength of the two countries, when Austria, which 193 years ago was unable to defend herself against Turkey without foreign aid, is now deliberating in concert with Russia, how she shall dispose of the fragments of that once formidable Empire.

is known to every reader of History, but none but the readers of Bonini ever heard of his victory over the Tiber.

So foolish a story may seem unworthy of insertion in a serious treatise. But it is given as an illustration of the superstition of the Romans, and of the tendency of the human mind to seek for the explanation of a phenomenon in occult causes, or supernatural agencies, rather than in the uniform action of some known and general law. It also shows the worthlessness of popular testimony either to miracles, or facts in science, where no personal interests are involved, and where nobody has any motive for contradicting a story, however absurd it may be. The object of those from whom Bonini received his account was to make out a case for a miracle and to flatter a Pope. On the other hand, it was a matter of indifference to those who were not under the influence of superstition, whether a story which they disbelieved obtained currency or not. If this is true of relations which shock the reason by their absurdity, it is truer still of popular notions in Science and Natural History. An account of a phenomenon in Nature, or of the habits of an animal originating in superficial observation, or the love of the marvellous, is accepted by a few who will not give themselves the trouble to investigate its truth, is adopted by others on the credit of the first hearers, and propagated from individual to individual, and from generation to generation, until it becomes an article of popular faith. The universality of the opinion is then appealed to as a presumption of its truth, as if all the individuals who held it, had arrived at the same conclusion by independent observation, or a distinct process of reasoning.

In the reign of Sixtus V. no great inundation occurred. But what he saw, coupled with what he had heard, led him to form the design of curbing the insolence of the river, as he had by his stern measures of repression destroyed the banditti that used to infest the states of the church. The following is the language used in regard to Sixtus V. and the Tiber by the author Bonini: "Sixtus V. the most imperturbable of Pontiffs, and the scourge of wicked men and assassins, could

not fail to have an opportunity of seeing an inundation of the Tiber, since he was born only for great things, and among others to curb that river, which, like a public bravo, was wont to assassinate the city and Campagna of Rome." Two, though not of the first magnitude, which happened in the last year of his reign, gave him an opportunity of displaying his benevolence in relieving the distress of the people, and at the same time suggested to him the appointment of a commission to enquire into the causes of these inundations, and to consult upon the means of preventing them, so that in time to come the City should be secure. But death prevented him from carrying out his designs.

The terms in which the Tiber is spoken of in this passage may appear inconsistent with the respectful language which Bonini generally uses in speaking of the river, and which reveals a feeling still lingering in the Roman mind, like that which their forefathers entertained for their native stream. But the matter is regarded from Sixtus' point of view, whose practical mind was devoid equally of poetical sentiment and of reverence for antiquity. One who dismantled the Septizonium of Severus, and contemplated the destruction of the tomb of Cecilia Metella, is not likely to have cherished any superstitious feeling for a river, or to have been influenced by any other consideration than the best means of abating a nuisance.

## INUNDATION OF 1598.

Whether Sixtus V. would have been as successful in dealing with the Tiber as with the brigands, is matter for speculation. But eight years after his death, and in the pontificate of Clement VIII., there occurred the greatest inundation of modern times, and equal, perhaps, to any of those which are recorded to have happened in the time of the Romans. For no measurement was given by the historians who describe them, and we have, therefore, no means of instituting a comparison. The event is thus noticed in the highest of the tablets attached to the building of the Minerva:

Anno Dom. MDXCVIII. 8, Cal. Jan.  
 Redux recepta Pontifex Ferraria  
 Non ante tam superbi hujusce Tybridis  
 Insanientes execratur vortices.

In the year of our Lord 1598, 25 Dec.  
 The Pontiff returning after the conquest of Ferrara  
 Curses the furious eddies of this our Tiber,  
 Which never before exhibited such pride.

Eight hundred persons are said to have been drowned, or to have perished by hunger, on this occasion. The Pons Emilius, which had been rebuilt by Julius III. and Gregory XIII. in place of the ancient structure, which had fallen down in the thirteenth century, was partially swept away. The broken portion, under the name of the Ponte Rotto, still remains, a picturesque object in a sketch, and an evidence of the force by which the ruin was effected. In the flowery language of Bononi "the woes and devastation of the city by the flood would have caused stones to weep," and an Italian of the time, called Guiseppe Castaglio, wrote a poem in Latin describing the destruction which it wrought.

In a preface to this poem addressed to the Cardinal Aldobrandini, Castaglio expresses his conviction that the flood was sent by God as a punishment for the sins of the people, which he proceeds to describe in detail. The Tiber here is no longer personified, represented as endowed with feelings, and acting on its own impulses, but described as an instrument in the hands of the Deity to accomplish his own purposes.

The river, he says, began to overflow its banks on the night of the eighth Cal. Jan., or twenty-fourth of December, increasing slowly that night, and the following morning. It then rose suddenly, and rushed with such violence through the streets, that in many of them people were afraid to trust themselves to the boats. The river rose to the first storey of the houses, and in many places even higher. On Christmas-day nearly all the people were confined in their houses, and unable to attend divine service, which was performed only in the churches on the hills.

On the fifth day the river retired within its bed, leaving the city in such a state that there was scarcely a street in which houses might not be observed in a falling state or propped up with timbers.\* The Pons Senatorius, the same as the Pons Emilius, and commonly called in those times Ponte di Santa Maria, was partly carried away, as I have already mentioned; the bricks in the upper part of the Ponte St. Angelo were displaced, and the shops, which then, as on the old bridges of London and Florence, encumbered the structure, were broken up.

\* It has been before observed that the wide-spread destruction among Roman buildings, especially farm-houses (*agros Tiberis super ripas effusus maxime ruinis villarum vastavit.*—Livy, iv. 49.) was owing, probably, to the material (sun-dried bricks) of which they were built, and the flimsiness of their construction. To the same cause was due the frequent collapse of houses in the middle ages. "Houses of poor people in those times were slightly built, of inferior materials, and their foundations laid but a short distance below the earth. They lived either in houses of one storey or on the lowest floor of higher buildings. Hence so many are recorded to have been drowned."—Pamphlet by Sigre. Aubert.

In his poem Castaglio describes the same incidents of the flood, and extols the benevolence of the Pope, and his unwearied exertions to save those who were in danger of drowning, and to supply food and shelter to all. In the inscription on the tablet which I have given, the Pope is described as cursing the river. I presume that this is a mere form of words, and that no formal imprecation was pronounced upon it. But Castaglio tells us that the Pope lifted up his eyes to heaven, and prayed to God that he would lay aside his wrath, and ward off destruction from the sacred city. He then stretched forth his hands in the form of a cross, on which the Tiber straightway stayed the violence of his course, and shrunk within his bed.

*Nam crucis in speciem simul atque extendere dextram  
In se te Tiberis sensit, violenta repressit  
Agmina continuo, notumque recessit in alveum.*

This was doubtless when the flood had nearly subsided, and when all the mischief had been done. It was a pity he did not perform the miracle at an earlier stage.

The details of the flood of 1660, which scarcely equalled in height that of 1870, may be passed over, as differing in no respect from those which have been recounted. But the observations of Bonini upon the Jews of the Ghetto, and an incident which he relates, will serve to illustrate the feelings entertained by the Christians of the time towards the Jews, and the hatred with which the Jews returned the scorn of the Christians. "That obstinate nation, says the author, derived, however, some benefit from the inundation; for while it refused to wash in the water of baptism the uncleanness of the soul, it beheld, cleaned away by that of the Tiber, the impurities of its body, and of its rooms, which, owing to the stench and to the filth, were in some places almost unapproachable. Yet the authorities, pitying even this reprobate people, ordered that an opening should be made into the Ghetto on the side of the Signori Cenci, that &c."

"It was a fine answer, says the same author, but envenomed with the native arrogance of the people, which was returned by

a wretched woman, a Jewess, to an ecclesiastic. She was almost immersed in the water, and the ecclesiastic exhorted her to withdraw herself from the danger with his aid, and to place her life in security from the fragments which were floating about. "No," she replied; "I have no need of the aid of the Christians, since it suffices the Hebrew to call upon the name of God; and at all times and in all places He will return an answer to his prayers." The ecclesiastic smiled and left her in the water.

## INUNDATION OF 1870.

The flood of 1870 will complete the series of inundations in modern times; for, if not the highest since 1598, it is the highest of which we have any details.

Of this inundation it cannot be said, in the words of Bonini, that "there were no indications by which it might have been foreseen," for none ever gave clearer warning of its approach. A flood into the Ripetta is usually the result of the last great fall of rain, that which closes a long spell of rainy days; after which the wind generally changes to the north-east, dispersing the rainy clouds, and arresting the melting of the snows on the mountains. But, on this occasion, when the river was three feet deep, the Ripetta had already invaded the lower portions of the town, and was still slowly rising, meanwhile, the weather, instead of clearing up, became worse than ever. On the Monday night (December 26) preceding the Wednesday, when the flood was at its height, the rain descended in torrents, accompanied with violent thunder and lightning. One clap was so loud that it shook the houses like an earthquake, and the lightning is said to have struck the Vatican, passing through the roof of the Pope's chapel and destroying a picture at the altar. Now, any one who has studied the phenomena of the weather, and the relation which they bear to the height of the floods, cannot fail to have remarked that the greatest rise of the river takes place after heavy rains accompanied by thunder and lightning; either because thunder and lightning indicate rains of abnormal violence in the Apennines, or because a given quantity of rain falls in a shorter time, and, therefore, less of it is lost by percolation and evaporation before it finds its way into the streams. If the war of elements were so great at Rome, it might have been inferred that it would be still more violent



among the mountains, and along the valleys through which the tributaries of the Tiber flow. Yet no warning voice was heard from the Collegio Romano, nor was the note of alarm sounded from the Capitol; though at both places meteorological observations are made. Nor had any one sufficient intelligence to infer what would be the effect of the addition to the swollen river of such a quantity of rain extending, in all probability, over the whole seven thousand square miles of the basin of the Tiber. The flood, therefore, which followed the rain at an interval of twenty-four hours, took everybody by surprise; the Corso was a river, and the shops of the tradespeople were invaded by the water, and their property damaged or destroyed, before they were well awake. On the twenty-eighth and twenty-ninth the city presented a singular spectacle. The Corso, and the streets which branch from it, instead of noisy carriages, were traversed by boats, rafts, pontoons, and even tubs, which, gliding silently along, conveyed bread and other provisions, candles and firewood, to the people imprisoned by the waters. As the boats approached, from every storey were lowered buckets, baskets, and towels, tied up at the corners by those who eagerly sought to obtain some small portion of the stores that were being distributed, such as a loaf of bread or a scrap of meat.

During the inundation the post-office was closed for nearly sixty hours, and for two nights, the twenty-eighth and twenty-ninth, the city was in darkness, owing to the flooding of the gas-works and the immersion of the pipes.

Nothing certain is known about the loss of life, the estimates varying from three to seventeen, and part of those who perished were drowned by the oversetting of a raft.

When the inundation had subsided on the thirty-first, and Victor Emmanuel paid his first visit to Rome, nothing could be more dismal than the aspect of the town. A cold rain was falling, the streets, abandoned by the Tiber, were ankle-deep with mud, and strewn with delicate articles irreparably damaged by the flood, while the foot-pavement was encumbered by piles of carpets, silks, velvets, and other costly fabrics

soaked with water, and coated with mud, waiting to be carted away, in order that they might be cleaned and sold for what they would fetch. Such was the sight which met the royal procession at every turn. But brighter skies and more prosperous times must long ago have effaced the impression produced on the mind of Victor Emmanuel.

The losses of the tradespeople and the sufferings of the poor, doubtless were great; but they were trifling compared with those which their forefathers had to endure in the inundations of 1530, 1557, and 1598. Not only was the river from six to seven feet higher during those floods, but the houses appear to have been slightly built, and of materials, like sun-dried bricks, which were liable to melt away in the water. Relief, also, was probably not bestowed on the same scale, nor with the same impartiality as at the present day. Hence we read of hundreds perishing by starvation or drowning, owing to the undermining and collapse of their houses. Houses now are more substantially built, and relief is better organised, and distributed without regard to race or creed; so that even the Jews of the Ghetto suffer only a temporary inconvenience during these visitations.

It is a singular fact that the three greatest inundations recorded in modern history happened in the sixteenth century, and within the period assigned by the Psalmist to the life of man. The author of the work from which I have extracted the account of the flood of 1557, and who lived in the interval between the second and the third of these inundations, imagined that floods were becoming more frequent than of yore, and appears to have anticipated that they would culminate in some great catastrophe like those which have marked the different geological epochs. A similar delusion seems to have prevailed in every age with regard to the weather, and the phenomena depending upon it. We constantly hear persons advanced in life observing, that the summers, or the winters, are very different from what they remember them to have been in their early days, and that the climate is undergoing a gradual change, sometimes for the better, but oftener for the

worse. Yet a little reflection, and the analogy of other sciences, ought to teach us that the order of nature is constant; that the phenomena of the weather depend on laws as fixed as those which regulate the movements of the heavenly bodies; and that rain, wind and frost must recur again and again in a certain definite order.

It is true that in the present state of our knowledge, and with the paucity of observations which we possess, we are unable to determine, even empirically, the period of the cycle, or the interval of time after which the same weather returns in the same order; but if we deny such a cycle to exist, we must suppose, either that the weather is left to blind chance, or that it is under the more immediate control of the Creator than any other department of nature, so that every fall of rain or gale of wind is a special act of Providence. The approach to regularity which we observe in the general character of the weather which prevails at different seasons contradicts the first supposition, and the second is manifestly absurd.

Doubtless, at some unknown period in the history of the world the same atmospheric conditions which produced the floods of 1530, 1557, and 1598, will return, and the Tiber again cover the Piazza di Spagna, and wash the steps of the ascent to the Trinità dei Monti. Perhaps, however, before that time the scheme for excluding the inundations by lofty embankments may be carried out. Whether such a remedy would not be worse than the disease will be considered hereafter.

Less irrational, but equally erroneous, is the assumption that, because rivers which overflow their banks raise the level of the adjoining country, their inundations must become less frequent in each successive age, and rise to a smaller height; and consequently, that such floods of the Tiber as are recorded in Roman times, and in the middle ages, can never again be witnessed. Those who hold this opinion do not seem to have enquired what has happened in the case of other rivers whose inundations are periodic, and whose phenomena have, therefore, been observed with greater attention. Were the notion

founded in truth, the Nile would long since have ceased to fertilize the valley and delta of Egypt, and the Ganges to convert the plains of Bengal into an ocean, during the season of the rains. On the contrary, the former river rises to the same height, twenty-three or twenty-four feet, which it did in the time of Herodotus, while the water, according to Sir G. Wilkinson, spreads over a larger area of country. Yet, such is the rise in the land, due to the annual deposit, that in ancient times it was found necessary to abandon many cities, and rebuild them on higher ground; while the deserted sites of others are gradually disappearing beneath the increasing accumulation of soil, and even the colossal statues of the plain of Thebes must ultimately be buried.\*

Why, notwithstanding this rise in the level of the land, do the inundations still continue, and even extend themselves more widely than before? The only explanation that can be offered is, that the bottom of the river is raised in the same ratio as the country which it overflows, and thus a fixed relation is maintained between the level of the two. A constant rise of the land contiguous to the banks, without a corresponding rise in the bed of a river, is a case that can scarcely be conceived. Mountain streams which flow over hard strata often scoop out deep channels in the solid rock, because, however slow the process may be, the sides can never fall in, so that the effect is accumulated during countless ages. Thus in the Jura the torrents may often be seen flowing at the bottom of deep ravines, which they have hollowed out in the limestone rock; and in the mountains of Auvergne new channels have been worn by the streams through the basalt which in former ages flowed across and blocked up their course.

In this case the bed of the stream is lowered relatively to the surface of the land; but the converse effect, the raising of the bank relatively to the bed of the stream, can never continue for any length of time, because the bank so raised is continually being undermined, and falling in; often partially

\* Wilkinson's Ancient Egyptians.

blocking up the river, and forcing it to seek a new channel, and consequently a new bottom. In fact, the tendency of rivers which flow with a sluggish current through an alluvial district is to raise their own bottoms, to obliterate their banks, and eventually, in many cases, to form shallow lakes or extensive morasses. Many of the morasses so formed have been drained, and the rivers kept within bounds by the labour of man. Firm ground and rich pastures have replaced the marshes of Somersetshire, where Alfred the Great sought refuge from the Danes, and the Val di Chiana with its rich agricultural produce now sustains the life which its miasmata once contributed to shorten; but, if the controlling hand of man were removed, these districts would doubtless revert to their original condition, as the Val di Chiana has done within the historic period. For we have evidence from Livy, xxii. 3, that in the time of the second Punic war, it was a highly cultivated region, which Hannibal, as he traversed it, laid waste with fire and sword, in order to cripple the resources of the Romans. Yet in the age of Dante, it had returned to its condition in primæval times, that of a dreary and pestilential fen; to become again, through the engineering operations of Fossombroni, the garden of Italy, and as healthy as productive.

An illustration on a much larger scale is afforded by the river Euphrates. The Euphrates was to Mesopotamia and Babylonia what the Nile is to Egypt. Its annual inundations were utilised to impart fertility to the land, and innumerable canals intersected the country, which conveyed the redundant waters to every portion of the soil, whose exuberant fertility excited the admiration of Herodotus.\* Yet the river was confined within prescribed limits; and when the inundation had subsided, the irrigated fields were left to mature their produce under a burning sun. What is the aspect of the river in the present day? For more than fifty miles above and

\* The return was two or three hundred fold; the leaves of the wheat and barley were four fingers broad; and the millet attained the dimensions of a small tree.—See Herodotus, Euterpe.

below its junction with the Tigris the river forms extensive swamps, penetrating scores of miles into the interior, which taint the air of Bassorah during the summer months, and occupy thousands of square miles of land which might be devoted to tillage. The river, when left to itself and allowed to overflow the plain without control, has simply encroached upon it, and, at the same time, its bed has become so shallow that none except steamers drawing but a few feet of water can accomplish the downward voyage.

To return to the Tiber. For two centuries the rise in the level of its bed has been a subject of debate, "*et adhuc sub judice lis est*," "the case is still before the judge." Conflicting evidence has been brought forward, and, what is stranger still, opposite conclusions have been drawn from the same facts. The engineers, Gambarini and Chiesa, hold that no appreciable change has taken place since the time of the Romans, and in support of this view they instance the platea, or foundation of the bridge of St. Angelo, which is uncovered when the water is moderately low, and the flooring of the sewers, which, with the exception of the Cloaca Maxima, are still, they say, above the level of the river.

Bonini, on the other hand, maintains that nothing but perversity, or the desire of appearing more learned than the rest of the world, would lead any one to dispute the fact of a rise in the bed of the Tiber; and this rise he considers to amount to twenty-four palms, or about seventeen English feet, which is evidently an exaggerated estimate. He grounds his opinion on the present condition of the Cloaca Maxima, and on the fact that Sixtus IV., when he rebuilt the bridge now called the Ponte Sisto, laid the new foundations on the "*pilastr*" and "*speroni*," or piers and cutwaters of the ancient structure; from which he infers that the bottom of the river at that point must have risen by a height equal to the height of the piers, or, in other words, must have risen so as to bury the piers, or what remained of them. Both of them appeal to the figure of a ship in the isle of St. Bartolomeo, but as their reasoning is based upon an assumption of the height above

the water, at which the figure originally stood, it would not be likely to carry conviction to the minds of others.

Bunsen adopting the estimate of Tinolle, makes the rise of the bottom from four to five feet.

Sig<sup>re</sup>. Aubert, who has lately written a work upon the Tiber, adduces, among other evidence in support of his belief, that the bottom of the Tiber has risen many feet since the time of the Romans. The moderate depth at which water is met with in sinking for the foundation of a house, is generally a little below, and sometimes actually above, the ancient pavements. He also mentions the fact, that the caves below the Colosseum, in which the wild beasts, intended for the spectacles, were confined, are now filled with water, when the river is in its ordinary state. The water in both cases can only be that of the Tiber, which has been filtered by percolating through the soil, or of springs, whose flow into the river has been arrested by the rise in the level of its surface.

But the strongest evidence is that afforded by the Cloaca Maxima. Strabo tells us that the sewers were arched with stones, nicely fitted together, and that the dimensions of some were such that a cart loaded with hay could pass beneath them.\* We learn from Pliny that they were traversed by boats in the ædileship of Marcus Agrippa,† and on referring to Dion Cassius we find that, while Agrippa held that office, among other great and useful works, he cleaned out the sewers, and then sailed beneath their arched passages into the Tiber.‡ Even if the great ædile, and son-in-law of Augustus, were content to bow his head, and the boat were pushed along with the hands, such a feat would be impossible in the present day.

It is clear from this, that in the time of Augustus the part of the arch above the surface of the water must have been sufficiently wide and high to admit of the passage of a boat,

\* Strabo, v. c. 235, 8, Ed. Teub. Meineke.

† Plin. xxxvi. 24, 104, Ed. Teub. Jan.

‡ Dio Cassius, XLIX. 43, 2, Ed. Dindorf. Teub.

and that the arch could not have been built, as has been suggested, when the river was at its lowest, in order that the sewage might be discharged into the Tiber below the surface of the water.

Next to the Cloaca Maxima, the Pantheon appears to me to afford the strongest confirmation of a rise in the bed of the river; for it is impossible to conceive that a public building would have been erected on a site which was at the time liable to be flooded by every trifling rise of the Tiber.

In these discussions it seems always to be assumed that, if the bottom rises at all, it must rise uniformly, and in every part; whereas the bridges, and other obstacles which exist in every town, occasion such a variation in the velocity of the current, that a great rise in one place may coexist with an actual lowering of the bed in another. Owing to the removal of London-bridge the scour above it was so much increased, that the foundations of Blackfriars-bridge were undermined, and it was found necessary to take it down and rebuild it. The bed of the river at Ponte St. Angelo may have undergone very little alteration, and yet above and below Ponte Sisto it may have been considerably raised. The rise of the bottom of the Tiber is partly owing to the quantity of rubbish, too heavy to be transported by the current, which is continually thrown into it; and this would naturally be the greatest in the most populous part of the city.

But the rise in the bottom of a river may not only be a fact to be established by evidence, but a necessary consequence of the protrusion of its delta into the sea. As the sea is removed to a greater distance, a line drawn from it to any given spot will make a smaller angle with the horizon, and, consequently, the average inclination of the bottom will be diminished. If the spot is not much raised above the level of the sea, the effect would at length be seen in the decreasing velocity of the current, and the decreasing velocity of the current would favour the deposit of matter, and thus the bottom would gradually be raised. But, meanwhile, the land on each side will continue to rise from the sediment



left by the river in time of floods; and this rise, of course will be the greatest in the oldest portions of the alluvial valley and the Delta, where the annual layers are the most numerous.

In this way the bottom and the banks are raised *pari passu* with the extension of the land, and, at the same time, a gradual slope is maintained. Thus, while in Egypt the rise in the level of the land is nine feet at Elephantine, at Memphis, near Cairo, it is seven feet, and in the Delta it continually diminishes as we approach the sea, until at the mouths of the Nile it is imperceptible.\*

From what has been said about the Euphrates and the Nile, it is evident that, if man pay due attention to the condition of the banks, nature will perform her part by maintaining the proper levels, and that when rivers are neglected, the tendency is rather to raise the bottom relatively to the banks than the banks in relation to the bottom. Thus, while the Euphrates has become in many places an immense morass, there are no instances of rivers flowing at the bottom of little valleys whose sides are formed by their own deposits.

To apply this to the Tiber. It is usually calculated that its delta advances at the rate of two metres a year. Sig<sup>re</sup>. Lanciani says that, as the result of accurate measurements made within the last three years, he has found the annual increase to be 3.5 metres at the Fiumicino, and as much as 9.025 metres at the Ostia mouth. Ostia is now three miles, and the port of Trajan one mile and a half distant from the sea.

This extension of the coast may appear insufficient to produce much effect upon the bed of the river. But there are other causes at work. Notwithstanding the rapidity of the Tiber, large sandbanks are deposited during floods within a certain distance of the sides, which are cut through when the river sinks to a lower level; the banks are continually falling in, and the soil is distributed along the bottom by the current. The river in the Campagna frequently changes its course, and the new bed would naturally be higher than the old one.

\* See Wilkinson's Ancient Egyptians.

It appears to be a law of nature, that running water, while it degrades the mountains, should raise the level of the plains, and with it the bottom of the rivers by which they are traversed. There is no reason to believe that the Tiber is an exception to the general law. Certainly, when we observe how much the level of the Campus Martius, and the Roman Forum, has been raised by the accumulation of rubbish, we must, if we hold that the bottom of the Tiber was never lower than at present, rest in the conclusion that ancient Rome was almost always under water.

In confirmation of what has been said, it may be added, that rivers, which are embanked, invariably raise their bottoms, so as to necessitate a corresponding raising of the embankments; until, in course of time, they flow, like aqueducts, above the level of the adjoining country, and continually threaten some great catastrophe.

I have treated the subject of the rise of the bed of the river at great length, not only because it belongs to the natural history of the Tiber, but because it has an important bearing upon the question of its inundations and their remedies. If the bottom and banks of the river maintain on the average a given relation to each other, we cannot hope that nature will do for us what we cannot do for ourselves, and place Rome at length out of the reach of inundations. The fact, therefore, of this constancy must be taken into account in any scheme for their prevention.

I come now to the consideration of the causes of these inundations; causes so simple and obvious that, if it were not necessary to shew the absurdity of the notions which are current on the subject, I should consider it a waste of time, and an insult to the understanding of the reader, to make a formal statement of them. Inundations of the Tiber never occur except during seasons of heavy and continuous rains; the height to which the river rises is always proportional to the quantity of rain which falls in the course of a day; and the time when the flood attains its greatest height bears a fixed relation to the hour at which the rain ceases at Rome,



the interval varying from twenty-four to thirty hours, according to the state of the river. The natural conclusion, therefore, would be, that the rain and flood stand to each other in the relation of cause and effect.\*

\* Nothing shows the unobservant nature of the Romans more than the fact, that no one to whom I have spoken has noticed, that the floods of the Tiber take from twenty-four to thirty hours to descend the River to Rome; twenty-four hours when the river is confined within its bed, and thirty when it has overflowed the Campagna. In this case the lake formed by the inundation acts as a regulator, and causes a more gradual rise and subsidence of the flood.

In every town on the banks of a river, a given relation is observed between the time at which a flood attains its greatest height, and the cessation of the rain by which it is produced. The floods of the Loire take a definite time to reach Roanne; and Vallès informs us, that in 1846 the inundation took sixty hours to descend the river from Roanne to Orleans, and sixty-two in 1856; a difference of only two hours, showing how easily the arrival of these floods may be calculated. The distance by the windings of the stream is under two-hundred miles, so that the velocity of the current of the Loire is only half that of the Tiber. The floods of the Medway take, as I have said, thirty hours to reach Yalding, a distance by the river of only thirty miles. Those of the Thames and the Severn do not arrive at Windsor or Gloucester for two or three days. The average process, therefore, of the inundations of the Tiber far exceeds that of any of these rivers, being at the rate of about seven miles an hour; which is unusually rapid.

The notion, that there is no connexion between the rain and the flood, prevents the Romans from observing the relation which exists between the time of these two phenomena, and the consequence is, that the flood takes them as much by surprise as if it were an earthquake, and always finds them unprepared. Yet every labourer on the banks of the Medway can foresee a flood, and tell within an hour at what time it will reach its greatest height. Why should not the Romans be able to do the same?

## POPULAR THEORIES REGARDING THE INUNDATIONS.

This explanation, however, is too simple to satisfy the unscientific mind, which delights in gratuitous assumptions and occult causes, the magnitude of which cannot be measured by the senses, and on which, therefore, the imagination can draw to any amount.

Bacon observes in his plain language that "men have a natural, though corrupt, love of the lie itself."\* Without going the length of Bacon, and affirming that men love falsehood for falsehood's sake, we may assert that few have any love of truth for the sake of truth, and that, when their material interests are not concerned, the majority do not care to investigate and bring it to light. On the contrary, they prefer to leave it in obscurity, because wider scope remains for the play of their fancy. When Tacitus put the "omne ignotum pro magnifico" in the mouth of the Caledonian chieftain,† he shewed his knowledge of human nature, and of the feelings by which most persons are influenced in judging of men and things. This indifference to abstract truth is especially observed in matters of science, where there is no question of material loss or gain; and opinions have been current since the time of Cicero which a few simple experiments or observations, recorded for a single year, would have shewn to have no foundation in truth.‡ It is in accordance with such a

\* Bacon's Essays, I.

† Taciti Agricola xxx.

‡ Witness the popular belief in the influence of the moon on the weather and in equinoctial gales. All scientific men of note, as Arago, Herschel, Admiral Fitzroy, &c., are agreed that there is no connexion between the changes of the weather and the changes of the moon. The belief in such a connexion is nothing but a relic of the astrological superstition which attributed to that planet an influence over men as well as things; the

feeling that the damming up of the waters of the Tiber by a Scirocco wind,\* and the increase of their volume by the melting of the snows on the Apennines, are the popular modes of accounting for the inundations of the river, while the rain, though it may promote the melting of the snows, is thought to contribute nothing to the mass of water. The latter notion I will examine first; for the former, though opposed to every principle of mechanical science, may seem to be borne out by what occurs in a few other rivers. It will be necessary, therefore, to examine it at greater length, and to shew how different are the conditions in the case of the Tiber and of those rivers where floods are actually produced by the action of the wind.

As the modern Romans take no account of the rain, so the ancients appear to have ignored the snow. Livy, in his notices of the floods, which occurred in different epochs of the history of Rome, always attributes them to rain. His words are invariably "*magnæ aquæ erant*" or "*ingentes aquæ erant*," "there were copious rains" or "there were great rains," and the Tiber overflowed its banks, &c. Tacitus, also, in describing

memory of which superstition is still preserved in the word "lunatic." Yet the notion will probably hold its ground to the end of time, because nobody has any personal interest in disproving it.

The belief in equinoctial gales is as old as the time of Cicero, who alludes to it; and in the present day these imaginary gales have been assigned by the government as a reason for modifying the original plan for the autumnal manœuvres of the troops. Yet, in the average of years, the fortnight before and the fortnight after the twenty-first September are fine and calm. The greatest storms on record have occurred either in November or nearer to the winter solstice than to the autumnal equinox. We might, therefore, with more propriety talk of solstitial than of equinoctial gales.

\* This appears to have been a generally accepted theory in the latter end of the sixteenth century. In a Latin poem of the time, written immediately after an inundation, the earth is represented as complaining to the Tiber, that it is despoiled of all its productions and all its beauty by the violence of the latter; to which the Tiber replies that it is not its fault, but the fault of the south wind, which bars the passage of its water to the sea.

At si forte graves aspirat ab æquore flatus,  
Egressum nostris impedit Auster aquis.

the inundation in the reign of Tiberius, uses the words "*continuis imbris auctus Tiberis plana urbis stagnaverat*." "The Tiber swollen by incessant rains had inundated the level parts of the city." Pliny, the younger, also describes an inundation of the Anio, the same to which we have before referred, which was caused by rains of extraordinary violence, so that great damage was done by the temporary torrents which they produced in places where there were no streams. Neither in these authors nor in Dio Cassius is there any mention of snow as connected with the rising of the river. In this they were nearer to the truth than the moderns; for though the snow aids somewhat in producing the inundation, and in exceptional cases may contribute largely to it, yet everyone who studies the weather and observes the phenomena of the river must see that it plays but a subordinate part. We have seen that the greatest flood but one recorded in modern history, was produced entirely by rains of unusual violence. On the other hand, there is no instance of any great inundation produced by the melting of the snows unaccompanied by heavy rain. In the January of 1871 there was an unusual accumulation of snow on the Apennines; yet, though melted by a warm Scirocco wind, and accompanied by gentle rains at the commencement, it only swelled the river to the level of the Ripetta.

It will be easy, however, to shew by a simple calculation that, under no conceivable circumstances could the effect of the snow equal that of the rain, and that the great rise of the river on Tuesday night and Wednesday morning, the twenty-seventh and twenty-eighth December, 1870, was due to the heavy rain of Monday night, the twenty-sixth. Fresh fallen and uncompressed snow occupies about fourteen times the space of water.\* On the night of Monday, the twenty-sixth,

\* Dove. *Meteorologische Untersuchungen*, Berlin, 1839, page 51.

It should be observed that the space occupied by snow depends upon the temperature at which it falls, being greatest when the temperature is low and the snow light and feathery, and least when the temperature approaches the freezing point and the snow is ready to melt.

But fourteen inches is the mean. Dove's observations agree nearly with my own.

there fell more than an inch and a half of rain. To produce the effect of this depth of rain, a foot and three-quarters of snow extending over the whole basin of the Tiber would be required. But the superficies of the Apennines covered with snow, even when the snow descends as low as two thousand feet above the sea, is not one-fourth of the area of the basin of the Tiber. The depth of snow, therefore, on the Apennines ought to have been seven feet on the level, and the snow ought to have melted in twelve hours, in order to produce the rapid rise of the river which took place on Wednesday, the twenty-eighth. Now, such a depth of snow is unknown on the Alps, below the region of perpetual congelation, except in drifts, and on the Apennines it is inconceivable, especially when a large part of it must have been dissolved by the Scirocco wind of the previous day and night; and as snow absorbs a large quantity of latent heat in the process of liquefaction, it would have required, even when aided by rain, three or four days to melt. The temperature of the plains never exceeded fifty-five or fifty-six degrees Fahrenheit, and the average temperature at an elevation of between two thousand and six thousand feet, corresponding to that temperature in the plains, would not be more than forty-three degrees Fahrenheit, a temperature at which it is impossible that the melting of the snow could proceed at a rapid rate. Anyone who has observed how long it takes for half-a-foot of snow to melt in the plains, even when a strong south-west wind is blowing, will see how impossible it is that such a depth of snow as would be required to produce the requisite quantity of water could have been dissolved in the mountains in the course of twelve hours. On the other hand, a given quantity of rain may be spread over several days, or may descend in half-an-hour with the violence of a waterspout. Sudden inundations, therefore, where the river comes down with a head of water, must always be due mainly to rain.

I now proceed to explain how tides or gales of wind may occasion floods in rivers, whose volume is not increased by rain or melted snow. When a river widens rapidly as it

approaches the sea, so as to form a funnel-shaped estuary, whose mouth is open to a stormy wind, the tides often rise to a great height, and floods occasioned by them or by storms of wind are of frequent occurrence in the low lying districts along their banks. When the tidal wave enters the mouth of the estuary, its progress is checked in front by the sudden contraction of the banks, and the hinder part retaining its momentum rises over it and adds to its height. The effect is repeated, as the wave advances up the estuary, until the height of the tide in the estuary far exceeds its height in the open sea. Thus the spring tides, which, according to Professor Airy,\* rise only eighteen feet at the mouth of the Bristol Channel, reach the height of more than thirty at Swansea and fifty at Chepstow; and in the bay of Fundy, between Nova Scotia and New Brunswick, they attain an elevation of one hundred and twenty feet.† The lower parts of London are often inundated by high tides at the time when it is low water in the German Ocean, the tidal wave by its momentum having, as it were, run up an inclined plane. In like manner, a gale of wind blowing into the mouth of a funnel-shaped bay may heap up the water at the narrow end far above its level in the open sea. In this way are produced the floods which have often devastated St. Petersburg. The stormy west wind blowing up the gulf of Finland drives vast billows into the open mouth, which rise to a great height at the narrow extremity. The waters of the Neva are dammed up, and rising above the quays overflow the city. St. Petersburg, as everyone knows, was originally a morass, but slightly elevated above the

\* Encyclopedia Metropolitana.

† (Land and Sea).—Yet at Green bay, on the north side of the isthmus which separates it from the narrow end of the bay of Fundy, it rises only seven feet. In the same work there is the story of a ship which during the night was deposited by the rising tide of the bay of Fundy on a rock of considerable elevation. We may conceive the astonishment and dismay of the crew at daybreak, when they found themselves suspended high in air, like an aerial vessel.

The story does not go on to tell us whether they got afloat again at high water.

Baltic, and a great part of it is built upon piles. The inundation, therefore, becomes part of the sea, and great waves roll through the town, and beat upon the houses as on stranded ships.

Three great inundations are recorded within the last one hundred years, those of 1726, 1777, and 1824, of which that of 1824 was the most disastrous. A violent west wind raised a barrier of water at the Neva's mouth, and the river rose until it had attained a height of from six to twelve feet in every quarter of the city. Immense waves raised by the hurricane beat with fury into the midst of the town. Entire streets were destroyed, and the miserable cottages of the suburbs were carried away, and their wretched inhabitants either buried under their ruins or engulfed in the Neva. Not only were boats swept into the midst of the town, but at Cronstadt, the port, a ship of a hundred guns was carried into the midst of a square, overthrowing all the buildings in its way. The number of victims was considerable, for there was no rising ground to which they could escape. In one of the barracks the soldiers sought refuge upon the roof. In a short time the waves had shaken the building, so that it fell to pieces, and all these unhappy men disappeared beneath the waters. These scenes of horror were repeated during the small number of hours which the inundation lasted. Happily the wind calmed after three hours, and in a short time the town was free from water.\*

Nothing like this could ever happen in the case of the Tiber, even if Rome were situated at the apex of the Delta or built on the site of Fiumicino, so as to be more within the influence of the sea. The river is scarcely wider at its mouth than it is for many miles higher up, so that a wave would not increase in height as it ascended the stream; and the wave at starting would not be more than about four feet above the sea level, which was the greatest height observed

\* Voyage en Russie, par Léon Renouard de Bussière. Lettre IV.

by Gambarini and Chiesa during the most violent storms.\* Again, the Tiber, instead of flowing into a funnel-shaped bay like the Neva, has pushed out a tongue of land into the sea, so that all the conditions on which floods produced by gales of wind depend, are here reversed. No force of wind, even if an Oriental cyclone were combined with a West Indian hurricane, could on this shallow coast heap up the water in the manner supposed by the advocates of the Scirocco theory of inundations. Were it possible for such a wall of water to be raised, it would not be confined to the Tiber's mouth, but extend along the whole coast, and flood far into the interior the low lying country which stretches north and south from eighty to a hundred miles. Yet such an effect has never been observed. The greatest floods, also, rise but little in the Delta of the Tiber, where, according to the theory which I am controverting, they ought to be the greatest. From Ostia to Torre San Michele, and thence to the sea, the rise is trifling.

But there are some who say that if the wind does not heap up the waters of the sea, and impel great waves into the mouth of the river, it may, when it blows against the course of the stream, retard by its friction the velocity of the current, and thus gradually raise the level of the water, until, either alone or aided by rain, it causes the river to overflow its banks. Theoretically, one would not expect that the friction of the wind on a nearly smooth and horizontal surface would produce any appreciable effect. But this is a question to be determined by observation and experiment. It is not found that other rivers are flooded, or sensibly raised by winds blowing against the course of their streams, unless their estuaries are of the form which I have described. No inundations of the Po are produced by easterly, or of the Rhine

\* Off the Cape of Good Hope waves are sometimes forty feet in height. In our seas, those about England, only ten and, in exceptional cases, eighteen feet (Land and Sea); but half this height is depression below the mean level of the sea.



by northerly winds, however violent they may be; and in the case of the Tiber, it is a remarkable fact that the days on which the greatest floods have occurred during the last thirteen years, have either been quite calm or with a light breeze from the north-east. The answer usually given by the advocates of the theory which attributes these floods to wind, when their attention is directed to this fact, is "that a heavy gale may be blowing at the mouth of the Tiber while a dead calm prevails at Rome." This is a purely gratuitous assumption, and so improbable—considering the short distance as a bird would fly, scarcely fifteen miles from Rome to the sea—as not to deserve a serious reply. Gambarini and Chiesa report that the effect of the wind in retarding the current of the river is extremely slight. This they ascertained by comparing the velocity of a piece of wood when the day was calm, and when there was a gale of wind blowing up the stream, and they ridicule the notion that the wind has any considerable effect in causing the rise of the Tiber.

To those who are not acquainted with Rome it may appear a waste of time and paper to argue against notions so absurd; but these opinions are held by many persons well known in the city, both Romans and English residents in Rome, and by diverting the public mind from the true causes of the floods of the Tiber, they prevent any effectual precautions being taken against them.

In the time of Bonini and Bacci, or three hundred years ago, it was the fashion to ascribe these inundations to the great quantity of water brought down by the Velino, which, along with the Salto and Turano, drains, as will be seen from the map, a large area of country; and Bacci speculates on the feasibility of diverting it from the Nera, and turning it through a rocky district abounding in caverns and chasms, which he fancied would be able to swallow it up. The same authors ridicule the apprehension which prevailed in those times that the "muro grosso," or great dike of the Chiana, which kept up a head of water in that river, would give way in time of floods, and liberate a mass of water by which Rome

would be submerged. These notions are mentioned along with the popular fallacies of the present day, to shew the tendency of the human mind to look for the cause of a phenomenon in every direction but that in which it is likely to be found.



## CAUSES OF THE INUNDATIONS.

Having shewn that the popular theories are insufficient to explain the great and sudden risings of the Tiber, I proceed to state the real causes of these floods. The inundations of a river depend:

1. On the area and form of its basin.
2. On the rainfall within that basin, and its distribution among the months of the year.
3. On the permeability of the soil traversed by its affluents.
4. On the number of its tributaries.

### I. AREA OF BASIN.

If a fall of rain extends over the whole basin of a river, the quantity of water which finds its way into the river and swells its stream, will, *cæteris paribus*, be proportionate to the area of the basin. On the other hand, the larger the basin, the less likely is a fall of rain to be simultaneous over its whole extent. It seldom happens that all the tributaries, even of the Tiber, whose basin has an area of only seven thousand five hundred square miles, are swelled at the same time, and in the same degree, and rarely, if ever, that those of the much larger basin of the Loire, of which the superficies is forty-five thousand square miles, are simultaneously flooded, though the same kind of weather may prevail over the whole centre and south of France. This is truer still of the Danube, which drains an area of more than three hundred thousand square miles.

The affluents of the Mississippi and the Amazon, which are equal to rivers of the first magnitude on the continent of Europe, belong to different climates, and different meteorological conditions; so that, while some are in high flood, others are at their lowest level. Hence there are two great risings of the Mississippi in the year, corresponding to the

seasons at which each half of its tributaries is flooded; the one in January, the other, which is the highest and the most dreaded by planters, in the month of June.\*

The great affluents of the Amazon, north of the equator, are flooded when the sun has passed that line and is advancing towards the tropic of Cancer, and the southern affluents during his passage towards the tropic of Capricorn.† Thus an equilibrium is established, and while the main stream has its own inundation during the spring and early summer, when it overspreads the country, sometimes for a hundred miles, at all times it retains its majesty, and rolls towards the Atlantic a vast body of water miles in width.

But high as the floods of these great rivers rise, their inundations can never be relatively as great as those of smaller streams, over the whole of whose basin some great storm of rain may burst at once. Elisée Reclus gives from Marchegay's "*Annales des Ponts et Chaussées*" an account of an extraordinary inundation of the Ardeche, in which that little river, not greater than a second rate tributary of the Tiber, rose in 1837 at the bridge of Gournier to the height of twenty metres and two-fifths of a metre, or about seventy English feet. On the other hand, the highest recorded flood of the Garonne,‡ rose only to thirteen metres or forty-two feet and a half, and the greatest height ever attained by the Seine was eighteen metres or thirty-two and a half English feet.

The basin of the Tiber, whose superficies exceeds that of the Thames by two thousand square miles, is large in proportion to the length of the main stream, and owing to the compactness of its form, which approaches in shape to a semi-circle, of which the centre is the confluence of the Nera, no one point is so far removed from another as to render it extremely improbable that a great fall of rain should occasionally extend over the whole of its surface, and swell simultaneously its tributary streams.

\* Elisée Reclus.

† Idem.

‡ Raulin *Géographie Girondine*, quoted by Elisée Reclus.

## 2. RAINFALL.

The rainfall within the basin of a river, and its distribution among the months of the year, is the second condition on which the occurrence of floods depends. How much depends upon the distribution of the rain appears from the case of Australia, where frequent droughts, during which the sheep perish by thousands, alternate with floods which are equally destructive to the crops and the cattle. Yet the annual amount of rain, both for Melbourne and Sidney, if uniformly spread over the year, would clothe the fields in perpetual verdure, and maintain a full and perennial flow in the rivers.\*

The average rainfall for Rome is a little above thirty-one inches, the extremes being forty-three and nineteen inches, neglecting decimals; and nearly the whole of this quantity falls during the nine months of the year when its effect is the greatest. The average for Florence is given at forty-two inches. If this be correct, the difference must be owing to the greater proximity of Florence to the Apennines. If forty-two inches be the average at the foot of the Apennines, and the extremes bear the same relation to the average as at Rome, we shall have about sixty inches, as the quantity which in exceptional years may fall over the whole region through which the tributaries of the Tiber flow.

From the source of the Tiber on the north to that of the Salto on the south, the distance, as a bird would fly, as I have said, is one hundred and forty miles. For this distance all the rain and melted snow from the western slopes of the Apennines must fall within the basin of the Tiber. If to this we add the contributions of the western tributaries, we shall have an explanation of the inundations of the river, as far as they depend upon the depth of rain which falls.

But how much of this rain finds its way into the river? This depends upon the permeability or absorbent qualities of

\* At Melbourne there fell in the year 1870 sixty inches of rain, and in the three months of January, February and March, 1871, sixteen inches. But this must be above the average, which I have not yet had an opportunity of ascertaining.

the soil, and upon the number of tributaries which intersect the basin of the river.

## 3. PERMEABILITY OF THE SOIL.

Of all soils the most permeable is pure silicious sand. It not only furnishes no water to the streams which traverse it, but abstracts a portion of their volume, and if the sandy district be extensive, ends by swallowing them up entirely. In this way rivers of considerable size are lost in the sandy deserts of Africa and Central Asia. Next in order of permeability comes the chalk, which is characterised, as everyone may have observed, by extreme dryness. No springs originate in strata of chalk, and no rivulets flow through chalky valleys. All the rain which falls upon the surface percolates through the soil, until it is stopped by some impervious stratum, when it either forms reservoirs in the earth or issues as a spring at a lower level. The same description will apply to the four inferior members of the Oolitic series, which are nearly as absorbent as the chalk. Vallès observes that in a district of two thousand square kilometres of such a formation, there was no trace of streams, all the rain which fell disappearing in the earth.

In a letter from the engineer Belgrand to the Geological Society of France, it is stated that on the fifteenth and sixteenth of October the enormous quantity of 1655 metres, or about six and a half inches of rain fell in the upper part of the basins both of the Loire and the Seine, rather more in the basin of the Seine than that of the Loire. Yet the Loire, which, in the upper part of its course, flows through the impermeable granite, was swollen to a great height, and caused losses which, according to the *Moniteur* of third June, 1847, amounted to forty millions of francs. The rise of the Seine, on the other hand, was so trifling that it attracted no notice.

The Medway affords another illustration of the connexion between the floods of a river and the nature of the soil through which it flows. The Medway is a river of a short course, but so sluggish that its floods take thirty hours to

descend the stream to Yalding, which is distant not more than the same number of miles from its source. Its tributaries all flow through the Wealden clay and Hastings sand, both impermeable strata. As soon as the clay is saturated in autumn, the rain runs off the surface as if it were paved. Every tenth-of-an-inch of rain produces a rise in the river, and half-an-inch causes a considerable flood.

The course of the Tiber and its tributaries is almost entirely through impermeable strata: the Jura limestone in the mountains, and the clays, sandstones, and tufas of the tertiary and post-tertiary strata. Hence its floods suffer little diminution from the percolation of water through the soil.

#### 4. NUMBER OF TRIBUTARIES.

The shrewd old tyrant Tiberius, when he attributed the floods of the Tiber to the multitude of its affluents,\* shewed that he understood far more about the matter than any of our modern engineers, who fancy that these inundations are caused by a few petty obstructions in the bed of the stream, as if rivers in a state of nature never overflowed their banks. Pliny enumerates two and forty rivers which flowed into the Tiber below the confluence of the Chiana.† Most of these are mere brooks, and, to avoid confusion, are omitted in the map prefixed to this work, but, if they were represented, the map would present a complete network of streams.

It may seem at first as if all the rain which falls in the quadrilateral formed by two great tributaries, the hills in which they rise and the main stream must find its way into the river, with the exception of the part which disappears at once

\* τῶν τε ποταμῶν τῶν Τιβερίδος πολλὰ τῆς πόλεως κατασχόντος, ὥστε πλευσθῆναι... ἐκείνος δὲ δὴ νομίσας ἐκ πολυπληθίας ναμάτων αὐτὸ γεγονῆναι, κ.τ.λ.—Dio Cassius LVII. 3, Tib.

The river Tiber having inundated great part of the city, so that it was navigated by boats.... he thinking that this was owing to the multitude of its tributaries, &c.

† Infra Arictinum Glanum duobus et quadraginta fluviis auctus, præcipue autem Nare et Aniene, qui et ipse navigabilis, Latium includit a tergo.—Plin. III. q. 11.

by evaporation and absorption. But this is not the case. In the steppes of Southern Russia, lying between the great affluents of the Don, small streams flowing into these affluents are rarely met with. Owing to the horizontal arrangement of the strata the water arising from the rain, after flowing for some distance, forms little ponds and morasses, and eventually either sinks into the earth or disappears by evaporation. On the other hand, the numerous little streams which intersect the basin of the Tiber convey the rain rapidly to the river before it has time to evaporate or sink into the earth. The result is the same as that produced artificially by thorough draining, which is said to have the effect of increasing the floods in winter, while it lessens the supply of water during the summer droughts.

It thus appears that the size and form of the basin of the Tiber, the large rainfall within its basin, the number of its tributaries, and the impermeability of the soil through which they flow, all conspire to increase the volume of its waters during seasons of heavy and continuous rain. To the increase of that volume the floods of the Tiber are owing, and not to the damming up of its waters by winds or artificial obstructions. When the rains are exceptionally heavy and extend at once over all minor basins drained by its tributaries, then we have a combination of circumstances producing those great inundations for which a remedy is being sought. But an efficient remedy will, I believe, be sought in vain.

In support of this conclusion let us examine the plans which have been proposed for preventing these inundations or lowering their height, so that they shall cease to be an inconvenience to the city.

## PLANS FOR PREVENTING INUNDATIONS.

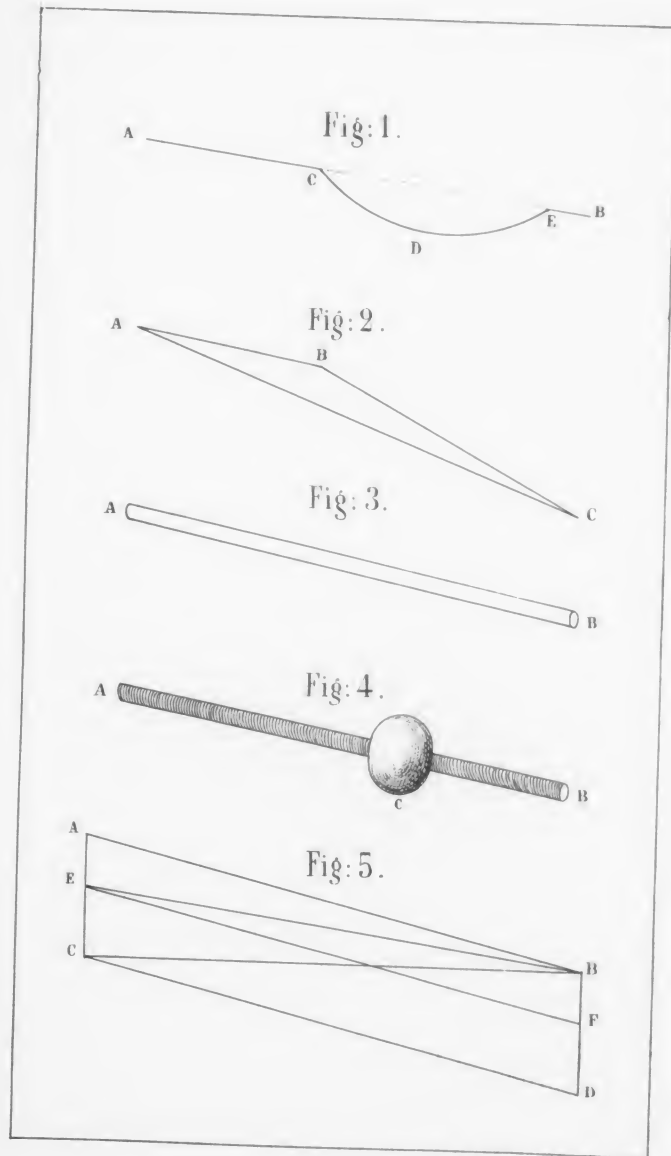
Manifold are the schemes which have been suggested for restraining the excesses and curbing the violence of father Tiber. It has been proposed at different times to widen him, to deepen him, and to straighten him; to weaken him by division, to check his riotous proceedings by cutting off his supplies, to imprison him between lofty embankments, and, finally, to banish him as an incorrigible scapegrace to some distant valley, where he might disport himself without injury to the rest of the world. The last scheme was proposed in the Pontificate of Sixtus V., but was never seriously entertained; perhaps because people, even in those times, had some conception of the engineering difficulties to be overcome, and some recollection of the services which the Tiber had performed in the age of the Emperors, when it was the principal channel by which the Romans were supplied with food. The other schemes, some of which have been tried and failed, while others which have not been carried into execution, will be examined in their turn.

### WIDENING AND DEEPENING THE BED OF THE TIBER.

Augustus, as we are told by Suetonius, "in order to check its inundations, enlarged and cleaned out the bed of the Tiber, which had long been filled with rubbish and narrowed by the encroachment of houses," and appointed a class of officers, with the title of "curatores alvei et riparum Tiberis," "curators of the bed and banks of the Tiber."\* The functions of these

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\* Ad coercendas inundationes alveum Tiberis laxavit, et repurgavit completum olim rudibus, et ædificiorum prolapsionibus coartatum. Suet. Oct. 30. The reading here gives a better sense than "prolapsionibus."



officers were enlarged by Tiberius, in consequence of the great flood which happened in his time; their supervision was extended over the whole course of the river, and they were required to discharge their duties, "so that in summer it should never sink too low or in winter rise too high, but flow always as uniformly as possible in height and strength"—a task which, it is needless to say, was beyond their powers.

From Augustus to Aurelian the office was held by the most distinguished men of senatorial and consular rank, who were proud, as appears from various inscriptions,† to add to their other titles that of "curator of the bed and banks" of their historical river. But, whatever may have been their attention to the duties of their office, they seem to have been powerless to contend with the Tiber; if we are to judge from the great inundation already described in the time of Otho, and from that in the reign of Trajan, of which an account is given by Pliny, the younger.

The truth is that the widening and deepening of a river—the only remedy which they attempted—can have no effect in lowering its level or diminishing the height to which the floods attain, unless the deepening or widening be carried to a point at which there is a great fall or rapid of the river. If ACEB (plate, fig. 1) represent the original bed of the river, and a portion of it CDE be dug out to any depth, the velocity of the current and the quantity of water discharged at B will not be affected. A great hole will simply have been made in the bed of the stream, which will be filled with stagnant water instead of earth; but the stream above it will flow onward as before, because the declivity from A to B remains the same.‡

\* πέντε αἱ βουλητὰς κληρωτὸν ἐπιμελῆσθαι τοῦ ποταμοῦ προσέταξεν, ἵνα μήτε τοῦ θέρου ἐλλείπῃ, μήτε τοῦ χειμῶνος πλεονάζῃ, ἀλλ' ἴσος ᾖτι μάλιστα αἱ ῥέγ.—Dio Cassius LVII. 3.

† For these inscriptions see Preller's "Rom und der Tiber."

‡ The inclination of the bottom in fig. 1, which is about one in six, far exceeds the average inclination of any mountain river. With such a fall, or even with one less considerable, the surface *might* be lowered by deepening



If, however, there be a great fall at B (fig. 2), and the river be deepened by cutting away the obtuse angle at that point, the declivity of the bed and the velocity of the current will be increased, and the surface lowered to AC. But there is no such fall at any point of the bed of the Tiber between Rome and the sea, the declivity of the channel being pretty uniform and not exceeding two-thirds of a foot in a mile. Again, the widening of the bed of the river would have no appreciable effect unless it were carried to a point at which there was a considerable fall, or continued of the same or greater width to the sea; otherwise nothing would have been done but forming two bays on each side of the former channel, in which the water would stagnate or revolve in eddies without any change of level. The floods of the Nile rise only a few feet in the Delta of Egypt, and in the Delta of the Tiber they are equally inconsiderable, because the water spreads over a wide area and is never afterwards confined within a narrower channel. The widening and deepening of the river by Augustus did not prevent the great flood in the reign of his successor, and in the present age it would be equally inoperative.

That increasing the breadth and depth of a river, as long as the declivity remains unaltered, can have no effect upon the volume of water which flows through it in a given time, will be rendered clear by supposing water to flow through a pipe AB (fig. 3) of given inclination and section. Would anybody imagine that the quantity of water discharged at B would be increased by causing the pipe to bulge out at C (fig. 4)?\*

the bed; but the deepening must *stop short* of a *horizontal line* drawn through E. It is evident, therefore, that in the case of the Tiber, and other rivers flowing through the plains, where the fall does not exceed one in six thousand, nothing appreciable would be gained by sinking the bed.

\* That deepening a river, as long as the declivity remains the same, can have no appreciable effect upon its level will be sufficiently clear from the diagram; but that no sensible effect will be produced by widening it for a few hundred yards, unless the fall is very great or unless the widening is carried to a point where there is a sudden and rapid descent, may seem to require a further explanation. Let AB (fig. 5) represent, as before, the

The straightening of the river need not be considered, as it finds no supporters in the present day. The expenditure would be out of all proportion to the results obtained, which would be an addition of a foot, perhaps, or a foot and a half to the fall, and a slight increase in the velocity.

#### DIVERSION OF A PORTION OF ITS WATERS.

The most popular scheme in every age for moderating the inundations of the Tiber has been to divert a portion of its waters above Rome, and either restore them to the river at a lower level, or convey them to the sea by an independent channel. Some have supposed that the canal referred to by Pliny the younger in the following passage: "the Tiber, though relieved by the canal which the most wise of Emperors has made, inundates the valleys and floods the plains,"\* commenced at some point above the Ponte Molle, and after being carried by a cutting through the Val del Inferno, was discharged into the country

surface of the river, and let AC be the fall in the distance AB. It is self-evident that, however much we may widen the river between A and B, we can never lower its level by a height equal to AC, because there must always be a fall from A to B, otherwise the river would cease to flow. Let AB be a mile and CA a foot, which exceeds the average fall of the Tiber in that distance in and below Rome, then by widening the river for a mile we could only lower its level at A by something less than a foot.

Nor would the level of the river in time of floods be lowered by more than this small difference.

For, since by supposition the breadth of the river at B remains unchanged, no more water can pass through it than before, and, consequently, no more water can be discharged by the widened part. Its level would not, therefore, be lowered relatively to the river at other points. On the contrary, the difference of level would be lessened, as I have shewn, by a rise in the river, and a portion of the advantage gained would be lost. If the river be widened, not, as I have assumed, for a mile, but only for two or three hundred yards, the lowering of the level in time of floods would be reduced to something trifling in the extreme.

\* *Tiberis quanquam fossa quam providissimus Imperator fecit exhaustus, premi valles, innatat campis* (Plin. VIII. Ep. 17 to Macrinus).—The most probable supposition, however, is that the canal in question was the present Fiumicino arm, which is considered by many to be artificial, and to have been dug by the Emperor, to connect the Tiber with his newly-created port.

below, and left to find its way to the sea; a monstrous supposition, as if there were no rights of private property in those days, or as if even an Emperor could turn a river through the lands of his subjects without any regard to the damage it might cause. It would not be surprising if the Tiber had avenged itself for the unceremonious manner in which it was turned out of a back door by laying waste the country, and tainting the air.

A plan for diverting the Anio from the Tiber was brought forward in the time of Clement VIII. The canal was to commence at the Ponte Mammolo, and after passing close to the walls of Rome on the eastern side, so as to serve as a wet ditch for the protection of the city, was to rejoin the river at the church of Santo Paolo without the walls. It was thought, that not only would the Anio be cut off from the Tiber, but in time of floods, a portion of the waters of the latter would discharge themselves through the Anio into the canal. In the opinion of Bonini very little good would be effected by such a diversion, because there are often floods of the Tiber without any increase of the Anio. The Anio, besides, drains but a small portion of the basin of the Tiber, as will be seen by inspection of the map.

All these proposals for drawing off a portion of the Tiber in time of floods, and restoring it to the river at a lower point, remind me of the ingenious device of the Irishman for lengthening a piece of cloth, by cutting off a portion from the top and sewing it on to the bottom. Every one would be sensible of the folly of trying to empty a reservoir by taking a pailful out of one end, and discharging it into the other. Yet the plans proposed are only a degree less absurd, when we consider the slight fall of the Tiber between Ponte Molle and the sea, and the great expense which would be incurred to lower the level of the floods a foot or two; if indeed it were possible to lower them as much.

Let AB (fig. 5) represent the surface of the river between Ponte Molle and San Paolo, the inclination being greatly exaggerated to make it sensible to the eye, and let CB be

the horizontal line. It is evident that whatever quantity of water we abstract at A, and restore at B, we can never lower the surface at A below the point C, otherwise the water would run back again from B to C. According to Chiesa and Gambarini, the fall of the river from the Ripetta to Ripa Grande is four and eleven-twelfths palms, or about three and a half English feet. Let us assume the difference of level between Ponte Molle and Santo Paolo to be eight feet. The effect of a rise in a river, as will be hereafter shown, is to obliterate differences of level,\* and render the declivity of the surface more gentle along the whole course of the stream. The difference of level, therefore, will be considerably reduced, say to five feet, and since the level of the flood at B will not be lowered at all, the difference at the Ripetta would be the mean between AC and O, or two feet and a half. But the whole, even of this difference, would not be gained. As the velocity of a river is always greatest in the middle, and the canal at its origin would have but a slight inclination, the same as that of the river itself, it would be extremely difficult to divert the current of the river into the canal,† and to make it draw off the required quantity of water. Again, the current from the canal when it joined the river again, by striking the stream of the river obliquely, would retard its velocity, raise its level above the point of junction, and in some degree neutralise the advantage which had been gained.

Altogether, the flood would not be lowered more, perhaps, than a few inches at the point where it is most important that

\* That is to say, if the difference of level is caused by an obstruction *over* which the river falls. In the case of a stone bridge, the difference of level increases as the river rises. In this calculation I leave out of consideration the effect produced by the Ponte St. Angelo, in keeping up a head of water, because such an act of vandalism as the removal of that bridge is not contemplated.

† It seems to be assumed that the Tiber would rush into the canal, as if a flood gate were opened in a reservoir. But there is no reason why, the levels being the same, the water should elect to enter the canal, rather than to continue its course in the main channel. Without a barrage, to which there would be objections which it would occupy too much space to discuss, it would be impossible, I believe, to lower the level of the river one foot.

it should be lowered; in the neighbourhood, namely, of the Ripetta and the Corso.

But not to speak of their inefficiency, canals through which the water was to discharge itself only in time of floods, whether they entered the river at a lower level, or were continued to the sea, would soon become an unmitigated nuisance. To say nothing of the first cost, a considerable expense would be incurred in maintaining these new channels, and keeping them open; otherwise, as the waters sank, they would become full of sandbanks, between which pools of stagnant water would collect; a rank growth of weeds would choke their beds; unwholesome vapours would be evolved from them during the heats of summer; and mosquitoes would find in them the breeding places which they most affect. The comparative immunity of Rome from mosquitoes is doubtless owing to the absence of stagnant water. Every one, who is acquainted with the natural history of that delectable insect, is aware that it passes the first stage of its existence under water, and that, when it is about to undergo its transformation, it rises to the surface. But, unless the water is perfectly tranquil, the winged insect, as it emerges from its larva case, is overset and drowned. The stagnant pools in these canals would, therefore, supply what the mosquitoes would doubtless consider a great desideratum to their race.

When a fire breaks out in a theatre, the tank that should extinguish the fire is usually found to be empty, and the pipes that should distribute the water to be out of order. So it would be with the canal. When a great flood came, it would be found that the banks had fallen in, that the bed was choked, and that the canal was incapable of performing its office.

#### PROPOSED EMBANKMENT OF THE TIBER.

Among the many schemes which have been proposed to the present government of Italy, in consequence of the late inundation, is that of embanking the Tiber. I shall, therefore, consider, first, the subject of embankments in general, and,

second, the expediency of embanking the Tiber under the actual conditions of that river.

The Tiber does not appear to have been embanked by the Romans. The idea did not occur to the commissioners appointed by Tiberius to consider the means of moderating its inundations, though far more feasible than the plan proposed by them of diverting its affluents; a plan which would be considered impracticable by engineers of the present day. The passage "*Tiberis ripas extruxi*," in the letter of Aurelian already quoted, has been translated by some, "I have raised embankments along the Tiber." It means, I think, merely: "I have built up the banks of the Tiber," that is, I have repaired the banks, faced them with stone, or supported them by piles. The whole tenor of the letter shows that the object of Aurelian was not to prevent inundations, but to remove obstructions to the navigation of the river, in order to facilitate the supply of grain, the great object of anxiety with the Roman Emperors. There are no traces of such a work as is supposed, though portions of it must necessarily have survived the lapse of ages.

In mountainous regions torrents are confined by mounds of earth and stone to prevent them from tearing up the ground, and converting the adjoining fields into a sandy and stony desert; but rivers in the plains were originally embanked, not for the purpose of preventing their occasional inundations, which are by no means an unmixed evil,\* but to reclaim land which was under water the whole or greater part of the year; for in those cases the declivity of the rivers was so slight that it was impossible to drain the country by lowering the level of their beds. High mounds, therefore, were erected along their course, sufficient to confine the river during the greatest floods,

\* Torricelli used to say that "*les limons*," or muddy deposits of rivers, were more precious than sands of gold.

During an inundation of the Loire in 1846 the plains of Forez above Roanne, where the river had liberty to expand itself, were overflowed, and many houses destroyed, yet the engineer in chief, Boulangé, declared that far more good had been done by the fertilizing deposits left by the flood than harm by the destruction of the houses.

and the stagnant water was allowed to evaporate or was removed by some mechanical contrivance. Such was the history of the Po, the Loire, the lower Mississippi, the Cambridge and Norfolk Ouse, and probably of the Euphrates, in ancient times.

In the age of Strabo the Po had no regular bed, but stagnated over the whole of Lombardy, forming lakes and marshes.\* Its dikes were the work of the middle ages. At Orleans a width of three thousand five hundred metres, or two miles and a quarter, and at Jargeau a breadth of seven thousand metres, or four miles and three-quarters, was continually liable to be overflowed by the inundations of the Loire. The space over which the river can range is now reduced to two hundred and eighty metres at the former place, and two hundred and fifty at the latter.† The Mississippi is bordered by wide tracts of low lying land, which used to be under water for long periods, when the river was swollen; and during the inundations of 1782 and 1828, the whole region comprised between the left bank of that river and the Yazou, a belt of fifty kilometres, or about thirty miles of mean breadth, was completely covered with water. To reclaim these lands, and allow them to be cultivated, the great levées of the Mississippi were raised. The great rise of the rivers, also, is not in the winter months, like that of rivers of shorter course, but in the month of June, when the crops are ripe, or approaching to maturity. It became, therefore, a matter of vital importance, in order to prevent the damage which the floods would cause at such a time, to confine the river by embankments which will prevent its overflow during the highest floods.

The cultivated lands which border the lower Ouse were gained from the sea, or from morasses, by embanking the river, and the waters which percolate through the banks, the small streams, and the pools left by rain or floods, are discharged into the river at low water, or raised to its level by means of pumps or syphons, of which windmills or steam-engines furnish the motive or exhausting power.

\* Strabo, v. l. 5.

† Elisée Reclus.

When, in consequence of high tides or heavy rains, the river overtops or bursts its banks, the whole country presents the appearance of an ocean, and the greatest difficulty is experienced in getting rid of the water.

The case of the Euphrates in ancient times was peculiar. Though embanked, it was allowed to overflow the country during its periodical inundations and deposit its fertilizing slime, because the stagnant water could afterwards be drained off into the valley of the Tigris, which lies at a lower level.

In none of these cases is there any precedent for embanking a river like the Tiber, which flows in a deep sunk bed, whose inundations occur only in winter, and which, after a few days, retires within its bed, leaving no large collections of stagnant water to impede the operations of the cultivator. The damage done two or three times in a century is as nothing compared with the inconveniences which would result from embanking a river which has so considerable a fall above Rome. If embanked in the Campagna, the river in time of floods, being prevented from spreading itself over the flat country, would enter Rome at a higher level, and thus necessitate the raising of the dikes much higher than has been calculated. If the embankments were confined to Rome, there would be great difficulty in isolating the city, and the duration of the floods would be prolonged, because the exit for them would be narrowed. Space must be left between the river and the dikes,\* otherwise the river would undermine and overthrow them, and the cost of the land for this purpose within the precincts of the city would be very great.

The drains must be greatly strengthened to prevent them from being burst by the hydrostatic pressure of the water, and they must be nicely trapped to prevent its escape. Means must be provided for getting rid of the water which would accumulate from the aqueducts, from the sewage, and from

\* These spaces, called *golenas*, are in the case of the Po sufficiently wide to be divided into fields and cultivated.



falls of rain during the two, three, or four days which the river might remain above the level of the town.

A proposition which I have seen for embanking the Tiber appears to be a revival of a scheme attributed to Bramante. Bramante is said to have given out that he had a plan by which, for the expenditure of a million of crowns of gold, he could secure the city against inundations, if not for ever, at least for a very considerable time. In those days the sum appeared to be excessive, and the proposal was rejected by Leo X. and his council. Bononi tells us that he was curious to learn the nature of the plan, and that a manuscript was brought to him, which he believed to be that of Bramante, and which contained the details of his plan. The principal feature of the scheme was a great sumpf to be dug in the lowest part of the city, to serve as a receptacle for the superfluous waters, while the river was at its height. This was to communicate by flood-gates with the river above and below the town, and, when the river had sunk to a certain level, the flood-gates were to be opened in order to flush the sumpf, and clear it of the mud which had accumulated during the flood. Instead of a continuous embankment, the ends of the streets, where they debouched upon the river, were to be closed against the inundation, and the lower windows were to be rendered water-tight. It is needless to discuss such a scheme, because the sumpf, and the space it would occupy, would be a sufficient objection at the present day.

But there are other and greater evils in embankments, which can only be counterbalanced by the profits derived from the land which they enable us to bring into cultivation. Rivers which are confined between dikes invariably raise their bottoms,\* and thus necessitate the raising of the embankments in the same ratio. The mud which should fertilise the fields encumbers their channels, or is carried onwards to the sea, where it impedes navigation by forming bars and shallows. In this

\* Though this is the general opinion of practical men, it is fair to observe that the fact is disputed with regard to the lower Po by some Italian engineers.

way the dangerous consequences which would result from the giving way of the dikes, increase year by year. The Po in many places, when flooded, is above the roofs of the houses of the adjoining towns, and the traveller, as he drives along the embankment of the Loire, and surveys the country stretched below him, and extending to the extreme verge of the horizon, speculates upon the devastation which would be caused by the rupture of the dikes. When at length the dikes give way in consequence of the pressure caused by an extraordinary flood, the water rushes like a cataract into the adjoining fields, sweeping every thing before it, and often covers the country as far as the eye can reach.\*

In 1856 the Loire opened seventy-three breaches through its levées, before considered "insubmersible," carrying away roads, overthrowing houses, and doing damage to the amount of one hundred and seventy-two thousand francs.† The damage done in such cases is so great that it has been asked whether it would not be better to throw down the dikes and replace them by trees thickly planted. The water making its way

\* During the inundation of the Loire in 1846, it burst the dikes by which it was confined below the town of Roanne, and committed great havoc; while above the town, where it had liberty to spread itself gradually over the fields, it was said to have done more good than harm.—Vallès, *Etudes sur les Inondations*.

Six ruptures of the dikes of the Po are reckoned by Lombardini during the present age. In 1836, in consequence of the rupture of the dikes at Astrakan, all the houses of wood were carried away and hundreds of persons perished. Owing to the bursting of the embankments of the Waal in 1421, seventy-two villages were swallowed up and one hundred thousand persons were drowned.—*Etudes sur les Inondations*.

† Elisée Reclus.

In 1856 the Loire rose at Orleans 7·20 metres, or rather more than twenty-three feet and a half, and reached within less than a foot of the top of the dike. But, though not actually overtopped by the flood, the dikes were, as I have related, broken through at various points. The author of a scheme for embanking the Tiber, which was put into my hands at Rome, proposes that the embankment, including a moveable parapet of several feet in height, should be sufficiently elevated to exclude the great inundation of 1598. He appears not to have considered that the river when enclosed between dikes would rise higher than when unconfined.



slowly through the trees would gradually cover the country instead of sweeping in a devastating torrent through it. Those who read the American intelligence in the "Times" may remember the account of the crevasse in the levée of the Mississippi at Bonnet-Carré, through which the water rushed for many weeks before it could be closed, inundating a great part of New-Orleans, and if the water had not found an outlet into the Lake Pontchartrain the damage would have been greater still.

In the October of 1872, a year after the above pages were written, there occurred an inundation of the Po, on a scale as extensive, and with results as disastrous as that of the Loire in 1846. Rains of unusual violence fell over the whole basin of the Po and its tributary streams, and, assisted by the melting of the glaciers of the Alps, raised the river to a greater height than it had reached during the present century. The consequences were foreseen, and "desperate efforts were made by the people of the neighbourhood to strengthen the dikes, which were continually being worn away by the raging flood. At Cremona, where seven hundred metres had become so thin that an enormous breach was every moment to be feared, the nearest houses and even a theatre were pulled down, in order to use the materials for the purpose of strengthening the crumbling bulwark; boats were sunk and tens of thousands of bags full of earth and stones were thrown into the bed of the river. With the same object at Casal Maggiore the materials of fifty-two houses and two churches, as well as fifty-four thousand bags of earth, were employed. But this mass of matter seemed a mere trifle to the all-devouring Po, which swallowed it up with ease, and continued its destructive course." The dikes at length gave way, and the waters rushed into the adjoining lands with a violence which may be conceived from what I have said of the Po, that it flows like an aqueduct above the level of the country which it traverses. "Not only the solid barns and substantial farm-houses peculiar to these districts, but even the churches were unable to withstand the force of the current. Many

human beings lost their lives, not only those who allowed themselves to be caught within the lower buildings, but those who fled for safety to the loftier buildings. The rush of waters continued until they had found their level; and vast tracts in the territories of Parma, Reggio, and Modena were turned into lakes. Twenty thousand families were rendered houseless, the fields they had sown were laid waste, and even the cattle which they had saved from drowning were perishing from want of fodder. What was a month ago the richest of plains is now a chaotic marsh, not unlikely to bear for years the marks of a few hours' havoc."

A still more remarkable illustration of the evils which arise from the attempt to confine rivers within their beds and prevent their inundations for an indefinite period is afforded by the Hoangho, or Yellow River of China. For ages huge embankments had been built to contain the stream, and these had to be heightened as the river silted up its bed. At length, in 1853, the pressure of the water suspended, as it were, above the adjoining plains became so great that the banks gave way at a point five hundred miles from the old mouth of the river in the Yellow Sea, and the river rushed like a cataract through the outlet it had formed. Turning northward, in obedience to the configuration of the surface, it swept everything before it, and, taking advantage of the channels of some of the smaller streams, finally forced its way into the gulf of Petcheli, so that the new estuary is three hundred miles distant in a straight line from its former mouth. Immense damage was done, the banks of the grand canal were burst, and wide districts were flooded.

According to the Mandarin Li, appointed by the Chinese government to draw up a report upon the cause and consequences of the disaster: the level of the old bed, or that abandoned in 1853, is actually thirty or forty feet above that of the adjoining country, and is now covered with rice-fields and villages, and forms a refuge in time of floods of the lesser streams for the people inhabiting the neighbouring districts.\*

\* Letter of a correspondent of the "Times," November 6, 1872.

Surely a practice must be wrong which leads to such anomalous results.

In Hunter's "Orissa" we have the following graphic account of the disastrous consequences of an inundation of the Mahanaddi, a river which, though greatly inferior in size to the Ganges, the Indus, or the Godavery, has a course of five hundred miles, and drains a considerable portion of the Peninsula of India. It was in 1866 that the inundation occurred, and the scene of the disaster was the Delta of the river.\* The branches into which it is divided are embanked, and floods caused by the bursting of the dikes are of frequent occurrence, alternating with the droughts from which the province suffers still more than from the floods. On this occasion, says Hunter, in the single district of Puri more than twelve miles square of solid land were suddenly turned into a sea, and this sea continued to cover everything for thirty days. Thousands of miserable families floated about in canoes, on bamboo rafts, on trunks of trees, or on rice-stacks, which threatened every moment to dissolve into fragments beneath them. Most of the hamlets have boats attached to the houses, and for miles the high thatched roofs are held down by bamboo stakes, so as to afford a refuge in time of floods. Starving colonies might be seen thus perched above the waters, while the Brahmins effected settlements on the roof of their brick temples, and looked down in safety as the flood roared past. From the first the cattle suffered terribly; sheep and goats were carried away by herds in the torrent, and in a few days their carcasses came to the surface covered with crows and scuffling kites. But the most piteous sight of all was the plough cattle standing in shallow parts up to their necks and hungrily snuffing the barren waters for food, until they sank exhausted into the slime. Before the thirty days were over many a famished family also had sunk beneath the waters.

\* "Orissa, Past and Present," by W. Hunter.

I will conclude with a letter of the "Times" correspondent from Egypt, dated October, 1874, shewing what a source of anxiety an embanked river is to the inhabitants of the districts which it traverses. In former times, before the cultivation of cotton assumed its present proportions, the annual inundation was allowed to cover the entire valley of the Nile as well as the Delta, only the towns and villages, which are built on rising ground, appearing above the sea of waters. At that time the crops which were cultivated consisted mainly of cereals and other plants, which were sown when the inundation subsided and gathered in before they were endangered by its return. But the cotton-plant is a biennial, or requires more than a year to arrive at maturity; it could not, therefore, be grown in the interval between two floods, and it became a matter of necessity to keep the great river within bounds by a system of dikes. These entail every year much labour, anxiety, and expense; for, whatever other public works may be neglected, the dikes must be carefully looked to, since the very existence of the cotton harvest depends upon them. On the present occasion the river rose to an unusual height, and apprehensions were entertained that it might overtop or burst its dikes. To prevent this calamity the greatest exertions were made both by the government and the people. No less than two hundred thousand men were distributed along the course of the river and great canals of Lower Egypt, and watchmen stationed in suspected places at every fifty or sixty paces. Most strange, says an eye-witness, was the spectacle presented by the Nile at night; the dark groups of fellahs massed on the dikes, patiently waiting the summons to give aid at some menaced point; the watchmen incessantly pacing up and down and uttering their prolonged guttural sounds of warning; the rows of twinkling lanterns and cressets following the windings of the banks until lost in the distance; and the swollen river faintly visible in the moonlight, rolling its turbid waters along with a force and a volume which nothing would seem able to resist. Lower Egypt and the cotton crop were saved, but wide tracts in the upper

course of the river were flooded and considerable damage done.\*

In England, as I have before observed, there are instances, though on a much smaller scale, of similar disasters, when the dikes of the Ouse† give way from the pressure of the water. But the Ouse is a mere brook in comparison with the Po at Cremona, and with the other rivers which I have mentioned, and its level is not so much above the adjoining lands. There is, therefore, neither the same volume nor the same rush of waters. Loss of life, destruction of buildings, or drowning of cattle is extremely rare, and the damage is usually confined to the spoiling of the crops.

It appears from the examples which I have given, that the results are invariable when rivers are embanked. A comparatively slight inconvenience is staved off for a time, until it attains the dimensions of a great calamity, and inflicts far more loss on the country than all the annual floods combined would have caused. What Horace says of the propensities of men, "*Naturam expellas furca tamen usque recurret*," is equally true of the material forces of Nature. If you try to thwart her, she will have her revenge at last. Embanking a river for the purpose of altogether preventing its floods is like trying to confine steam, whose elasticity is perpetually increasing, by strengthening from time to time the vessel in which it is contained. Sooner or later, by some accidental increase in the heat or by some miscalculation of the addition which should be given to the thickness of the vessel, the steam will gain the ascendancy and a destructive explosion will occur. In like manner some mistake is sure to be made in raising and strengthening the banks, so as to suit the variations in the depth, direction, and velocity of the stream. Supervision is troublesome, and is at length entirely neglected, when long impunity has bred indifference and a feeling of false security; some weak point is overlooked, and then comes an unusual

\* "Times," October 7. Dated Alexandria, September 6.

† The Huntingdon and Norfolk Ouse.

fall of rain, and the embankments are either overflowed or swept away. The security of a whole province should never depend upon vigilance to be exercised for an indefinite period, for vigilance, unless kept alive by frequently recurring alarms, is sure to go to sleep at last.

I have observed in a former chapter that rivers which flow with a sluggish current have a tendency, especially in the lower part of their course, to form marshes by obstructing their channels and obliterating their banks. Such was the case with the Po in the time of Strabo, when a large part of Lombardy was nothing but a morass. The proper course for redeeming the land would have been, not to embank the river, but to dredge its bed and to remove, as far as possible, every obstruction to the flow of the water. Afterwards transverse embankments should have been formed, extending from the Po to the nearest rising ground. If there should be no rise in the ground for a considerable distance, the embankments might be made to curve inwards at their extremities, so as to unite at last and enclose a space. The river, then, should have been allowed to have its own way and overflow the land at will. The earthworks which I have described by dividing the flooded area into compartments, within which the water was comparatively stagnant, would have prevented the current from tearing up the ground, and at the same time have favoured the deposit of mud. The sediment would at once have fertilised the ground and raised its height above the Po. Something would have been gained every year, and, as in the case of the Chiana, the land would have continued to rise, until, in course of time, the due relation was established between the level of the river and that of the country on either side. Floods would still have occurred, but they would have been far less destructive in their effects, and when the river fell, the water would all have drained into it, leaving the land free for the operations of the agriculturist. But now, owing to the depression of the country below the level of the Po, the water of the inundation can disappear only by evaporation or by soaking into the earth; and, therefore, remains for

weeks or months upon the ground, chilling and scouring the land, and preventing it from being prepared for future crops.

But, as matters have gone so far, nothing remains but to strengthen the embankments, with the certainty that, while averting misfortune for the present, we are increasing the danger for the future, and preparing for another age a calamity still more disastrous than any which has occurred.

The embankment recommended by the government commissioners is very different from the dikes of which we have been speaking. By embankment they understand quays along the river side, faced with stone, like the new Thames embankment or the Lung' Arno at Florence, but not rising much above the present level. These, which are the most sensible thing they recommend, would be an ornament to the town and a pleasant promenade for the inhabitants, but would have no effect upon the floods. Lofty dikes, such as I have seen proposed, high enough to exclude the great inundation of 1598, would be an eyesore and shut out entirely the view of the river, already too deeply sunk between its banks, while they would entail all the inconveniences on which I have enlarged.

#### REMOVAL OF OBSTRUCTIONS.

There remain now to be considered the proposals for removing the obstructions in the bed of the river, as a means of lowering the level of the floods. The removal of many of these obstructions would improve the navigation of the Tiber, and give the river a more tidy appearance, but would have no sensible effect on the height of the floods. The widening of the arches of the bridge of St. Angelo might, indeed, lower the level of the water above it a little, though less, I believe, than is supposed; for I have never observed a difference of more than a foot, or so, between the height of the river above and below the bridge. But to suppose that the removal of the piers of the Sublician bridge, or any other obstruction which rises but a foot or two above the surface of the Tiber at low water, could sensibly lower the level of the

floods, betrays an extraordinary ignorance of the phenomena of running water. The effect of an obstruction is measured by the difference of level which it produces; and the effect of a rise in the river is to obliterate that difference of level, and to render the declivity of the surface more uniform, as well as to diminish its inclination to the horizon. Any person, who takes the trouble to observe, may satisfy himself of this. If there is a weir across a river, it will be seen that, as the river rises, the fall diminishes, until the fall becomes a rapid. As the rise continues, the violence of the rapid lessens, until at length nothing but a ripple marks the place where the fall once was. As the river sinks, the rapid re-appears, and then the fall. The same effect is produced at every trifling descent until the whole surface become more uniform, and makes a smaller angle with the horizon. It is evident, therefore, that those objects which are buried deep beneath the flood, like the piers in question, can have no appreciable effect upon its height.

#### RESERVOIRS FOR RETAINING THE FLOODS.

I have thus examined the schemes which have been proposed at different times for moderating the inundations of the Tiber, and have shown, as I conceive, how inefficient they would be. But there is one to which no reference is made by the commissioners, if I may judge from the abstract of their report which appears in the Italian papers. Vallès, after discussing the various plans which have been tried or suggested for preventing the disasters caused by the overflowing of the rivers of France, and pointing out the disadvantages of all, especially of the system of longitudinal dikes, gives the preference to a plan, approved by many other engineers, of forming vast reservoirs in the mountain valleys, to retain a portion of the water of the tributaries of these rivers during heavy rains. The floods would be lessened by the amount of water which these reservoirs could contain, and when the inundation had



partially subsided, the reservoirs, which would be provided with means of rapid discharge, might be emptied and ready for another flood. When all danger of floods was over, the rain water might be allowed to accumulate and reserved for the purpose of irrigation. The plan, he observes, has been tried on a pretty large scale in comparatively level districts, with the object of feeding the canals; and he complains of the apathy of his countrymen, who, wedded to old practices, cannot be persuaded to give to his system the extension he recommends, but are content to jog along in the old path, patching up the dikes, and using different modes of construction in different parts of the country, which only serve to counteract each other.

Into the details of this plan, the cost, the appropriate sites for the reservoirs, and the profit to be derived from the irrigation, I will not enter; my business being only to indicate general principles. But it appears to me that under certain circumstances these reservoirs might aggravate the evil and increase the floods, by keeping up the level of the river in the interval between two great falls of rain, and thus enabling the latter to produce a greater effect.

It is doubtful whether such a plan would be entertained by the Italian government. To say nothing of the expense, if the Romans are as fanciful as of yore, they would not like the thought of these great reservoirs suspended, like the sword of Damocles, above their heads. I have mentioned the absurd apprehension which prevailed in the sixteenth century, that Rome would be submerged by the giving way of the "muro grosso," or dike of the Chiana, an apprehension which Bacci ridiculed, and tried to remove by showing that, owing to the narrowness of the Chiana, the head of water kept up by the dike, which is only seventeen Roman palms, or twelve English feet in height, would be lost in the bed of the Tiber. I have related also how the Romans at a later period opposed the formation of a new outlet for the Velino. They were apprehensive that some fine morning the Veline lake on the plateau of Reati might take advantage of

the new opening, and come down bodily on the town of Rome.\*

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\* This apprehension, though absurd in the case of a lake, which shelves gradually from the shore, and can never discharge itself at once, is not without foundation in the case of an artificial reservoir confined by a barrier which may be swept away in a trice. Many persons will remember the bursting of the Holmfirth reservoir, when many houses, mills, &c. were swept away and many lives were lost. I myself saw a manufactory which had been cut in two by the rush of waters as neatly as if it had been done with an instrument, leaving the machinery exposed or projecting from the floors.



## ANIMALS OF THE TIBER.

The Tiber, for long distances between its source and Rome, flows through a country almost as solitary as the wilds of Canada or Australia. While the banks of the Thames, throughout the greater part of its course, are lined with towns or villages and adorned with the villas of the rich and noble; scarcely a village is to be seen on the immediate banks of the Tiber. Borgo St. Sepulchro and Citta di Castello, twenty and thirty miles respectively from its source, and Terni and Narni on the Nera, are the only towns which are situated on the banks either of the main stream or of its tributaries, and all four are insignificant in extent and population. One or two little hamlets may be built close to the water's edge; but, with these exceptions, the course of the Tiber for more than two hundred miles is silent and solitary. Pastures and thickets unrelieved by cultivation bound the river on either side, and, except at the railway stations, the face of a human being is rarely to be seen. Hence many birds and animals which shun the neighbourhood of man, as kingfishers and otters, find shelter and a convenient breeding-place in the steep banks and thickets of the Tiber, while others which breed elsewhere, as herons, resort to the river for security and food. The kingfisher, which is scarce in England, where it is exposed to many casualties from the density of the population and the greater severity of the winters, is comparatively plentiful on the Tiber and the smaller streams which discharge themselves into it; for there it can always find the retirement which it loves, and procure the food on which it subsists in the larger or smaller streams, which remain unfrozen throughout the year.

In treating of the fauna of the Tiber I shall confine myself to a limited number of species, giving in detail the history of those birds and fishes alone which are most interesting from their

classical associations, their singular instincts, or the popular notions regarding them, and noticing briefly or merely naming the others. On the subject of Natural History, as of science in general, it is extremely difficult to procure information in this city. The Romans are a singularly unobservant and uninquiring people in all matters which do not affect their personal interests. This is owing to the state of mental tutelage in which they were held so long, and which led them to take their opinions upon trust, instead of seeing and thinking for themselves. Even those connected with the University, whose duties require them to deal with the subject of Natural History, do not think it incumbent upon them to learn the names and study the habits of the birds and quadrupeds which haunt the banks of their native streams. When a question relating to the animals of the Campagna is put to them, the answer usually received is "Chi to sa," "Who can tell," accompanied with a shrug of the shoulders, as if it was not their business to tell. More information is to be gleaned from English sportsmen than from Roman professors, and partly from this source and partly from books the history of these animals will be given.

## BIRDS OF THE TIBER.

### THE GULLS.

Among the birds which frequent the Tiber the foremost place must be assigned to the gulls, which, during the winter season, may be observed hovering over the river, and occasionally dipping down to seize a small fish which is swimming near the surface, or a piece of garbage which may be floating past. This species (*Larus ridibundus*) is about the size of a pigeon, and is the one which is most frequently seen in the interior of the country. It appears, indeed, to prefer fresh to salt water, and in Italy during the winter some of them may always be seen flying over the rivers and marshes, even at a considerable distance from the sea. Wherever the rivers have overflowed their banks or the rain has inundated the plains, thither innumerable flocks of them repair, which continually wheel above the surface of the water, now resting and now resuming their flight, while they are ever in chase of the insects which in such places swim and sport upon the stagnant pools.\*

These gulls are migratory as well as gregarious birds, and during the summer wing their flight to more northerly regions, where they build their nests and rear their young. The late Bishop of Norwich (Stanley) in his "History of Birds," informs us that the *Larus ridibundus*, or red-legged gull, as it is called, annually takes possession of an island in Norfolk, about thirty acres in extent, and builds its nest. In Ireland, the black-headed gulls, as they are also named,† frequent, for the same

\* Ornithologia Toscana del dottore Paolo Save.

† Great confusion is created by calling the *Larus ridibundus* black-headed gull, and at the same time giving the scientific name of *Larus melanocephalus* to another species, which is, perhaps, only a variety of the "*ridibundus*."

## BIRDS OF THE TIBER.

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purpose, the gravelly beach of a portion of Ram's island in Lough Neagh, and so closely are the nests placed on the ground that Mr. W. Thompson and some friends, when visiting the place, had to use great circumspection in setting down their feet, that they might not do injury to the nest or eggs.\*

During the interval between late autumns and early springs, flocks of these birds may be seen gracefully skimming over the surface of the Tiber, especially when the river is low, and swooping down every now and then upon their prey, which consists of insects, as well as of small fish and carrion. All day long they are on the wing, and, like the swallows, never seem to tire; for rarely are they seen to float upon the water, and, like their congeners of the sea,† to rest themselves by riding on the waves. At night they retire to the neighbouring meadows. They seem to stand in little awe of man, and in their gyrations will pass close to barges in which are men at work; nor do they pay much attention to the stones which mischievous boys occasionally fling at them. It is a pleasing sight to a naturalist to stand on the banks of the Tiber and watch their movements. Now that firearms can be more freely used than under the former government, it is hoped that none of the so-called sportsmen will molest these interesting birds, and drive them from the city to more tranquil haunts.

### THE KINGFISHER.

No winged creature has been the subject of so many fables as this shy and solitary bird. In the account which the ancients have given of it, they seem in the most literal sense to have drawn on their imagination for their facts, and to have sat down in their closets and invented a history for a creation of which they scarcely knew, with certainty, the colour or the form. It was feigned that the kingfisher built its nest and

\* See Thompson's Natural History of Ireland, and Birds of Ireland.

† *Larus canus*, the common gull, and *Larus marinus* the black-backed gull.

reared its young upon the surface of the sea,\* which, even in the depth of winter, maintained a perfect calm in order to suit the convenience of the bird.

Perque dies placidos hyberno tempore septem  
Incubat Halcyone pendentibus æquore nidis.  
Tum via tuta maris; ventos custodit et arcet  
Æolus egressu, præstatque nepotibus æquor.—Ov. Met. xi. 745.

Seven days on nest that floats upon the wave,  
The winter sea unruffled by a breeze,  
The Halcyon sits. Then Ocean's paths are safe  
To all that sail; for Æolus guards the winds,  
Forbids them exit, and his daughters brood†  
Assures 'gainst all the dangers of the deep.

The fable of the Halcyon is older than the time of Aristotle, who relates it, without any misgivings, as an established fact in Natural History,‡ though he confesses that in the climate of Greece the seven days preceding and following the winter solstice were not always fine and calm, as the popular story assumed.

For many hundred years, with the vitality of error, this fable held its ground. Plautus, who lived before, and during the second Punic war, thus alludes to it:

Ag. Jam hercle tu peristi; ni illam mihi tam tranquillam facis  
Quam mare est olim, quum ibi alcedo pullos educit suos.—Poenulus I. ii. 145.

By Hercules 'tis you that are undone, unless you succeed  
In making her as calm towards me as is the sea at the  
Time when the Alcedo is rearing her young upon it.

Every one knows the origin of the expression "Halcyon days;" but many have imagined, from the difficulty of applying to the kingfisher what is said of the halcyon, that the kingfisher and the halcyon were different birds. The description,

\* The belief of Aristotle and of Pliny, who merely copied from him, was that the halcyon was a sea bird which occasionally ascended rivers, and Virgil appears to have been of the same opinion. Thus:

"Non tepidum ad solem pinnas in littore ponunt"  
"Delectæ Thetidi Alcyones."—G. i. 399

† Halcyone was daughter of Æolus.

‡ Aristotle de historia animalium.—Lib. v. cap. 8, at the end.

however, given by Aristotle of the plumage of the halcyon leaves no doubt of its identity with the kingfisher.

When we consider the wildness of this bird, and the lonely character of the river bank which it frequents, and beyond which it never extends its flight, it is not surprising that its true history should have remained unknown to the ancients, who never sought out an animal in its native haunts, for the purpose of making themselves acquainted with its habits. Pliny would not even take the trouble to procure a specimen of the kingfisher when dead, in order that he might be able to describe with accuracy its plumage and its shape, but contented himself with copying the description of Aristotle, which he contrived to mistranslate in a most important point. Aristotle correctly described the halcyon as having a long and slender beak: τὸ δὲ ῥύγχος ὑπόχλωρον μὲν, μακρὸν δὲ καὶ λεπτὸν;\* "the beak is greenish (or rather yellowish) but long and slender." Pliny, through ignorance, or carelessness, translates "ῥύγχος" by "collum," and thus represents the kingfisher as having a long and slender neck,† than which nothing can be more contrary to the truth.

The kingfisher, "Alcedo ispida,"‡ is called by the Italians "Uccello pescatore," and also "Uccello della Maria," not from any legend which connects it with the Madonna, but from the azure on its back, a colour which the early painters were fond of introducing into the drapery of the Virgin. It is now known that, so far from building its nest upon the sea, it builds no nest at all, but lays its eggs in the hole of a water-rat, the depression left by the hoof of a horse near the banks of a river, or in any natural or artificial hollow, enlarging or contracting it to suit its convenience, and lining it with the small fish bones which it ejects in pellets. Neither is it true that the period of its incubation is about the winter solstice; for in Italy the young are hatched in the month of March,

\* Arist. de Historia Animalium.—Lib. ix. cap 14.

† Pliny.—Lib. x. cap. 47 (32).

‡ The derivation of "ispida" is uncertain. It has nothing to do with "Hespida."

and in England in the beginning of April. The only circumstance in which the true history of the kingfisher agrees with the fable of Ceyx is in the attachment of the male to the female, and the fidelity of the former to the latter while she is sitting on her eggs or rearing her young. Other birds grow thin while they are sitting; but the female kingfisher is said to be fatter than at any other time, from the quantity of fish which is brought her by the male.

The kingfisher, as its name implies, feeds upon small fishes, as well as aquatic insects. For two or three hours together it will sit upon a branch overhanging the stream,\* waiting until it sees a fish within its reach, when it darts down upon it with the speed of lightning, and having brought its prey to land, despatches it with repeated strokes of its bill. If there are no trees, and it is obliged to watch upon the gravel, it makes a bound into the air of twelve or fifteen feet, and then plunges into the water from that height. From the rapidity with which it launches itself upon its prey, it is called by the Italians, in addition to other names, "*piombino*," or the plummet, though the word scarcely conveys an idea of the quickness of its movements; for, if it allows a fish to drop, it often succeeds in recovering it before it reaches the ground.

Frequently, especially when the water is turbid, the kingfisher may be seen flying close to the surface or the stream with a rapidity which is astonishing, when we consider the shortness of its wings, and, as it flies, it utters a piercing cry.

During the colder winters of Germany, when the rivers are partially frozen, it is often observed, while pursuing its prey, to plunge beneath the ice, whence the name of "*eisvogel*,"

\* The kingfisher naturally chooses a dead branch, which, being bare of leaves, allows a better view of the river below. Yet such is the propensity of the human mind to falsehood that the French peasantry, according to Buffon, attribute to the kingfisher the power of blasting the branch on which it settles; though common sense ought to have taught them that the bough is not withered because the bird perches upon it, but that the bird perches upon it because the bough is withered. I have been told by a friend that a similar superstition exists among the peasantry in England.

or "*icebird*," has been given to it in that country. Sometimes, when the streams are frozen completely over, dead kingfishers are found, which have perished, either from cold or from inability to procure their usual food.

No such casualties are to be dreaded by the kingfishers of the Tiber, which have nothing to fear, except the cruelty of man. To the English, the name of "*icebird*" appears strange, because it suggests the idea of a denizen of the polar regions, a bird which dwells habitually on the borders of the ice; but to the Romans it must seem stranger still, when they see the kingfisher darting along the surface of the river and its tributary streams, which are never known to freeze.

The flesh of the kingfisher is said to have a musky odour and unpleasant taste. This, and its rapid and irregular flight, which makes it difficult to take a proper aim, are its chief security against the Italian sportsman, who considers everything as game from a heron to a wren, while everything which has life is food for the ordinary Roman. Innumerable singing birds, each of which is scarcely a mouthful, are killed with the gun, or caught in nets, by the tasteless Romans, who have more pleasure in eating a nightingale than in listening to its song.

According to Gesner, the kingfisher cannot be tamed, and before the last forty or fifty years, I am not aware that any one had succeeded in keeping it alive for more than a few months. Daubenton, of the Academy of Sciences, fed them, Buffon tells us, for several months with small fish placed in a basin of water; but we are not informed of what became of them at the end of that time. Buffon himself was less fortunate. Fish, he observes, must be the only food suited to them; for, of four full-grown young birds brought to him from the nest, two constantly refused the flies, ants, earthworms, and cheese which he offered them, and perished of inanition at the end of two days, while the two others, which eat a little cheese and a few worms, lived only six.

Now, however, that the economy of animal life is better understood, we are enabled to imitate the conditions which are



essential to the life and health of the different species, and to naturalise them in our parks or confine them in our Zoological Gardens.

"I love," says Waterton, speaking of the kingfishers in his park, "to take my stand behind a large tree and watch the kingfisher as he hovers over the water, and at last plunges into it with a velocity like that of an arrow from a bow. I sometimes fancy that it is all over with it, when I see it plunge into a pond which I know to be well stocked with ravenous pike; still it invariably returns uninjured, and prepares to take another dip."

In the Zoological Gardens, also in the Regent's Park, London, the kingfishers appear to be perfectly healthy and happy, and readily catch and devour their fish; for there the conditions under which they live in a state of nature have been successfully imitated.

#### THE HERON.

The *grallatores*, or waders, are birds of passage in the climate of Rome. The heron, for instance, which remains all the year round in England and the north of Europe, spends only the winter months in central Italy, and quits it for cooler regions when the heats of summer have begun to dry up the marshes which it frequents and to limit the means of procuring its usual food. The difficulty, also, of finding convenient breeding-places in the parched and naked Campagna must determine the migration of the greater part, for a few are said to remain and build their nests in the Pomptine marshes, where they can find the retirement which they love, and enjoy the freedom from molestation which at such a time is indispensable to them.

The common heron, "*Ardea cinerea*,"\* is not unfrequently seen in the neighbourhood of the Tiber and its tributary streams, though it is often overlooked by those who cannot discern it at a distance or recognise it in the air by its peculiar mode

\* The "*Airone*" of the Italians, called, also, "*Scarza cinerea*," and the "*Aschegrauer reiher*" of the Germans.

of flight. Sometimes it is flushed in the brooks and ditches which discharge themselves into that river; sometimes it is seen standing motionless, a picturesque object in a landscape, on the sandy spits which project into the stream, or among the thickets of reeds or underwood which line the banks; and sometimes it is observed sailing across the country from one fishing station to another. On these occasions it often rises to an immense height, and, when at a great elevation, presents a singular appearance. Its meagre body, which is laterally compressed, appears then reduced to a mere line, and the large concave wings seem to have nothing to support.

According to Virgil, before storms of wind and rain it soars above the region of the clouds:

notasque paludes  
Deserit, atque altam super volat ardea nubem.—G. I. 363.

While the crane, with more good sense, forsakes the regions of air and flies for shelter to the bottoms of the valleys:

illum surgentem vallibus imis  
*Aeræ* fugere grues.—G. I. 374.

Whence this difference in the behaviour of birds so nearly allied? We can only reply that, as instinct is unerring and directs an animal to what is necessary to its preservation, it must lead species which are closely related and whose habits are similar, to act in a like manner under the same circumstances. We may assume, therefore, that the lofty flight of the heron before a storm is a fancy of Virgil or a popular error of the day.

Buffon writes in a very sentimental strain about the heron, and describes it as leading a life of unmitigated wretchedness. When it is seen standing like a lifeless image on the river's bank, as if absorbed in inward contemplation, but in reality intent upon the movements of the fish, this imaginative writer pictures it to himself as brooding over its own miseries, and almost indifferent to the preservation of a life which, for it, is nothing but a burden. Even the more matter-of-fact Willoughby attributes its meagreness—for, notwithstanding its size, it weighs but three or four pounds—to the constant state



of anxiety in which it lives. This meagreness is the more remarkable when we consider the voracity imputed to the bird, and how it devours indiscriminately not only fish but frogs, every kind of aquatic reptile, and even water-plants when other food is scarce. The frogs it appears to swallow whole, for the bones are observed to be discharged unbroken.

Of the persecutions to which it is subjected there can be no question, whatever effect they may have on its corporeal frame. The love of cruelty and the propensity to destruction, which are almost instinctive in the human breast, for they are seen in greatest intensity in boys, uneducated persons, and uncivilized nations, disposes the common herd\* to attribute noxious qualities to almost every animal in a state of nature,†

\* To the love of cruelty and the love of mischief we may add the love of lying, which Bacon (Essays i., line 15) declares to be natural to man. This love of falsehood leads the vulgar to invent stories of the ferocity and venomous properties of certain animals, which every naturalist, from his acquaintance with the peculiar organization of these animals, knows to be physically impossible. Against the amiable trio which I have mentioned the poor animals would have little chance, if the superior intelligence and energy of the small minority who take them under their protection did not make up for the paucity of their numbers. If the nation had been polled, the act against cruelty to animals would never have been passed; if the Society for the Prevention of Cruelty had not been formed, that act would never have been enforced.

† The vulgar errors respecting the toad, the hedgehog, the goatsucker, the woodpecker, and in Italy the brown lizard, called the "Gecko," are illustrations of this. All these animals are insectivorous, and, therefore, beneficial to man; yet nothing will convince the country people that the first is not venomous, and that the second does not milk cows and carry away apples on the point of its spines. In some old parish accounts the ratepayers are debited with certain sums paid as rewards for the destruction of "urchins," as hedgehogs were then called. In other words, the householders of the parish were made to pay for the destruction of an animal which was not only harmless but actually useful to them, and which is sold in Covent Garden market as a destroyer of noxious insects. The goatsucker, as not only its popular but its scientific name implies, is supposed to drain the udders of goats, and the woodpecker to injure trees by boring holes in them, though it merely makes an opening into the cotton cavities where insects lodge and breed, and by devouring them removes one source of damage to the tree. The Gecko, called by the Italians "Tarantula," which possesses the power not only of climbing walls but of walking, like a fly, upon the ceiling of a building, is perfectly harmless, and feeds, like the other lizards, upon insects; yet it is assumed to be venomous, because its colour and form are

in order that they may have an excuse for ill-using and destroying it. Even in the older naturalists something of this disposition may be discerned, while the moderns, being better informed, are more disposed to extenuate the supposed evil doings of the animal creation, or, as in the case of the sparrow, to set off the good they do against the pilfering, of which they are occasionally guilty in our fields and gardens. Thus Willoughby, who lived in the seventeenth century, speaks of the quantity of fish destroyed by the heron. Waterton, on the other hand, who, as everyone knows, made his park an asylum for every kind of persecuted creature, thus expresses himself with regard to that bird: "I encourage this poor persecuted wader to come and take shelter here, and am glad to see it build its nest in the trees which overhang the water, though carp and tench and many other sorts of fish are there in abundance. Close attention to its habits has convinced me that I have not done amiss. Let us bear in mind that the heron can neither dive nor swim, and, therefore, in shallow water only can it surprise the fish; and even then, when we

repulsive, and while it is darting along the walls in pursuit of its prey is supposed by the stupid Neapolitans to have entered their houses with some fell intent.

Of the combined love of cruelty and mischief, and, we may add, stupidity, we have additional illustrations in the shooting of swallows at the time when they are serving mankind by hawking for insects and of sea-fowl during the breeding season. These birds are often very useful, by warning ships by their cries of the vicinity of rocks, which are invisible, owing to the density of the fog. To prevent the extermination, therefore, of the sea-fowl in certain localities it was found necessary to enact a law against molesting them at the time when they are sitting on their eggs or rearing their young. To these instances we may add the wanton destruction of elephants in India. Everyone knows that this animal rarely breeds in captivity, and that the supply of domestic elephants, which are a necessity in that climate, is recruited from the wild herds that range over the uncultivated districts of the provinces of Tipperah and Chittagong, lying east of Calcutta and the table-lands of Mysore, or roam through the forests of Ceylon. Some time ago an act was passed for their preservation within certain limits; yet such was the havoc committed amongst them by "sportsmen" that there was danger of a failure in the supply, and it became necessary to pass a more stringent act, which, in the case of the elephants of Mysore, has lately (July, 1874) come into operation.

see it standing motionless and suppose it to be intent on striking some delicious perch or passing tench, it is just as likely that it has waded into the pond to have a better opportunity of transfixing a water-rat lurking at the mouth of its hole\* or of gobbling down some unfortunate frog which had taken refuge in the rush-grown margin of the pond. As the ordinary food of these birds consists of reptiles, quadrupeds, and fish, and as the heron can only catch fish when they come into shallow water, I think we may fairly consider this wader not very injurious to our property, especially when we reflect for a moment on the prodigious fecundity of fish."

Heron hawking was formerly a favourite amusement of the nobility in England and the north of Europe. On these occasions both hawk and heron soar to an immense height, each striving to rise above the other, the hawk to acquire the impetus for making its deadly swoop, the heron to escape it by gaining the vantage ground. The reader may remember the vivid description in Sir Walter Scott's "Betrothed" of the chase of the heron by the falcon. In this we have a faithful account of the behaviour of the birds as they strive to outstrip one another in their upward flight, but naturalists have doubted whether the heron ever awaits the onset of the falcon in the manner described, and impales its enemy on its bill.

The flesh of the heron was highly esteemed in former days, ranking with that of peacocks and pheasants, and the proprietors of heronries often derived a profit from the sale of the young and tender birds. Now it is supposed by most persons to be a rank and unpalatable food. Selby,† however, declares that, when in good condition and well cooked, it is little inferior to some of our most approved water-fowl.

On account of the sport which it afforded and the estimation in which its flesh was held, the heron was protected by severe pecuniary penalties, and heronries were far more numerous than

\* Waterton tells us that the bank of an artificial piece of water in his park, which was much infested with rats, was almost entirely cleared of these vermin by the herons which he encouraged to breed upon the trees beside it.

† Illustrations of British Ornithology.

in the present day. Now they are found on the estates of only a few landed proprietors, where they are retained as an appendage to the state of the wealthy and high-born owner, or protected as objects of natural curiosity.

In France they were established in the forest of Fontainebleau by Francis I., who took a great pride in them. In Italy I cannot learn that they ever existed, though falconry was practised to a certain extent, and the heron was one of the quarries at which the hawk was flown. The Italians seem never to have possessed that love of simple nature and that interest in the animal creation which has been displayed by nations of Teutonic origin; which led the English to imitate the wild and rural in their gardens, and to encourage the heron to breed near their mansions; which, also, led the Dutch to protect the stork that breeds upon their roofs.

Buffon thus describes and moralizes upon the behaviour of the heron in captivity: "When a heron has been taken, it may be kept for fifteen days without being observed to seek or to take any nourishment. It rejects even that which they try to make it swallow. Its natural melancholy, increased, no doubt, by captivity, prevails over the instinct of self-preservation, and the apathetic heron perishes without complaining and almost without appearance of regret." Whether it be true or not that the captive heron refuses food and starves itself to death, it is certain that when taken young it may be tamed and will know the person by whom it expects to be fed.

A young heron was formerly called a heronshaw (from the French "heronceau," diminutive of heron), which word has been corrupted into "handsaw" in the line of Hamlet:

When the wind is south, I know a hawk from a handsaw.—Act II. 2.

The heron is seen in the neighbourhood of Rome from the middle of October to the middle of May, and even later. During the winter it haunts the river both above and below the city, but towards the close of the season only below it.

## THE BITTERN.

As Pliny had never seen a specimen of a kingfisher, so he appears to have known nothing about the bittern. He copies, indeed, from Aristotle the names of three species of heron, among which was the "asterias," or bittern; but there is nothing in his Natural History to indicate that he knew anything about the form or the habits of the bird. The sounds resembling the lowing of cattle, which were heard, he says, in the neighbourhood of Arles,\* were undoubtedly the booming of the bittern, though he incorrectly attributes them to a small bird which he calls the "taurus."

Aristotle, on the other hand, was acquainted with the bittern, which he calls "asterias," "stellaris"; but he was as much in the dark as Pliny with regard to the strange noise which it makes. Having no suspicion that the loud sounds which reached his ears from the recesses of the marsh proceeded from a bird, he sought an explanation of the phenomenon in the expulsion of air from caverns by the sudden rush of water.† These sounds, which resembled, he tells us, the bellowing of a bull,‡ were heard by the superstitious with religious awe and attributed to oxen sacred to the god.

The booming of the bittern, which is the call of the male during the breeding season, is its chief peculiarity, and has procured for it in Lincolnshire the name of "miredrum," or drum of miry places; in Italy of "trombone," or the great

\* Plin. Hist. Nat. x. 41, 57.

† This conclusion of Aristotle is a good illustration of the different mode in the investigation of truth adopted by the ancients and the moderns. A modern naturalist would have penetrated into the marsh, traced the sound to its source, and thus discovered the animal from which it proceeded. The physical labour and discomfort of such researches was not to the taste of the ancient philosophers, who preferred sitting down in their closets and framing some ingenious hypothesis to account for a natural phenomenon. But as the hypothesis was neither based upon observation nor verified by experiment, it was usually wide of the truth.

‡ Διὰ τὴν [ἐν] ἔλσει τοῖς παρὰ τοὺς ποταμοὺς γίνονται οἱ καλούμενοι βοῦμικοι, οὗς μυθολογοῦσι ταύρους ἱεροὺς εἶναι τοῦ θεοῦ; ἐστὶ δὲ τὸ γινόμενον ψόφος ὅμοιος ψωνῇ ταύρου, κ. τ. λ., Aristotle, ὅσα περὶ τὸν ἀέρα φυσικὰ προ-βλήματά. κε. 3. (25. 2).

trumpet; and in Germany of "erdbull," or earthbull, in addition to the more common name of "rohrdommel." The name of "erdbull" is, perhaps, the expression of the popular belief that the sound is produced by thrusting the bill into the ground. To this belief Thompson, in his "Seasons," alludes in the following verses:

So that scarce  
The bittern knows his time, with bill engulfed  
To shake the sounding marsh.—Spring, v. 21.

It is scarcely necessary to observe that the effect of burying its bill in the earth would be to deaden instead of to increase the sound of the air proceeding from the lungs.

The booming is so loud that it may be heard, it is said, at the distance of a mile and a half. Belon, a French naturalist, declares that no bull can bellow as loud.

The bittern is rarely seen and spends the day in extensive marshes, where it remains concealed from the view of all its enemies, while it finds in such places the food on which it subsists. This consists of water reptiles, frogs, and rats, which it swallows entire. In Grave's "British Birds" it is stated that the intestines of one dissected in 1811 contained the remains of four eels, several water newts, a short-tailed field-mouse, three frogs, two buds of the water-lily, and some other vegetable substances.

It is owing to the habits of this bird and the instinct which leads it to seek safety in concealment that it is seldom or never to be met with on the Tiber above Rome, where the marshes are few and of limited extent. It is in the extensive morasses on the lower course of the river, reaching in breadth from Ostia to Macarese, that the bittern must be sought. From these reedy coverts it is very difficult to dislodge it, and the sportsmen must beat for these birds with pointers, for they lie so close that, like the jack snipe, they may almost be trodden upon before they will rise; and it is frequently necessary to traverse two or three times, up to the knees in water, the marshes in which they lurk. From its immobility during the day the bittern received from the Greeks, as we

are told by Aristotle, the name of *ὄκνος*, or the sluggish.\* He adds that it was fabled to have been transformed from a slave into a bird, and is, as the name would imply, very sluggish in its habits.

It is only at sunset and in autumn, according to Willoughby, that the bittern quits the spot where it had lain for many days concealed.† It then ascends in a spiral course to an enormous height, as if to take a survey of the country, and select a new abode. From its lofty flight on these occasions, Scaliger fancifully derived its specific name of "*stellaris*," as though it were given to it because it soars towards the starry vault of heaven. Others think that it derives its name from the marks on its plumage, though these are not disposed in the form of stars.

The bittern, as it mounts, utters a re-sounding cry, quite distinct from its booming noise. This cry, heard in the stillness of the night, has often impressed those that were abroad with superstitious awe. Willoughby believes the bittern to have been the night-raven, at

whose deadly voice  
The superstitious wayfarer of the night  
Turned pale and trembled.

Others think, with better reason, that the night-raven was the "*Ardea nycticorax*," whose specific name ("*nycticorax*") means "raven of the night." No species, it may be observed, of the true raven, or of the genus "*corvus*," is a nocturnal bird or flies abroad after sunset.

The bittern, like the heron, was a bird of chase and placed under protection of similar game laws. The taking of one of its eggs was, in the reign of Henry VIII., punished by a year's imprisonment and a fine of eightpence. Its flesh, also, was considered a delicacy by our forefathers, and even in the

\* *ὁ δὲ ἀστερίας ὁ ἐπικαλούμενος ὄκνος*.—Arist. de Hist. Anim. ix. 18.

† Though most naturalists are agreed that the bittern remains quiescent during the day, I have met with English sportsmen who declare that they have seen it flying backwards and forwards in broad daylight over the country that borders on the lower Tiber.

present day it is found to be good eating, if care be taken to strip off the skin of the breast and wings, for the capillary vessels of the skin contain an acrid oil, which in the process of cooking diffuses itself through the flesh.

Whatever may be thought of the heron, the bittern can scarcely be accused of devouring human food, unless a Frenchman should grudge it the frogs, which form the larger portion of its ordinary diet. Yet, of those who would neither taste its flesh nor care to preserve its skin, few would be found to spare its life if it came within their reach.

In addition to the four species which I have described at length, the following aquatic and wading birds frequent the lower Tiber and the marshes at its mouth:

<i>Ardea (Botaurus) minuta</i> .....	Little Bittern.
<i>Ardea nycticorax (nycticorax griseus)</i> ..	Night Raven.
<i>Ardea (Herodias) garzetta</i> .....	Little Egret Heron (rare).
<i>Ardea purpurea</i> .....	Painted Heron.
<i>Ardea ralloides</i> .....	Buff-backed Heron.
<i>Ibis Falcinellus</i> .....	Bronzed or Glossy Ibis.
<i>Ibis religiosa</i> .....	Sacred Ibis (very rare).
<i>Himantopus melanopterus</i> .....	Stilted Plover (called by the Italians "Cavalier d'Italia")
<i>Machetes pugnax</i> .....	Ruffs and Reeves.
<i>Vanellus cristatus</i> .....	Lapwing.
<i>Numenius arquata</i> .....	Common Curlew.
<i>Œdicnemus crepitans</i> .....	Stone or Whistling Curlew.
<i>Scolopax rusticola</i> .....	Woodcock.
<i>Scolopax Gallinago</i> .....	Snipe.
<i>Scolopax Gallinula</i> .....	Jack Snipe.
<i>Podiceps cristatus</i> .....	Crested Grebe.
<i>Podiceps auritus</i> .....	Long-eared Grebe.
<i>Podiceps minor</i> .....	Dab Chick.
<i>Fulica atra</i> .....	Common Coot.
<i>Rallus aquaticus</i> .....	Water Rail.
<i>Anas clangula</i> .....	Golden-eyed Duck (called "Morettone" by the Italians).
<i>Anas Boschas</i> .....	Mallard, or Wild Duck.
<i>Anas clypeata</i> .....	Shoveller.
<i>Anas Penelope</i> .....	Widgeon
<i>Anas Tadorna</i> .....	Sheldrake } occasionally only.
<i>Querquedula crecca</i> .....	Common Teal.
<i>Anser ferus</i> .....	Wild or Grey Goose.



The following are rarely seen :

*Phœnicopteria antiquorum*.....Flamingo.  
*Platalea leucorodia*.....Spoonbill.

By far the larger portion of the species enumerated are found only on the lower Tiber and in the marshes at its mouth ; but some of the waders and swimmers are met with in the winter higher up than Rome. Such waders as seek their food on shingly sea-shores, like the "oyster-catcher" and "turnstone," are omitted, as not pertaining to rivers, like the Tiber, with muddy banks.







*Lampreys of the Tiber*  
*Anguilla*  
*Lucioperca*

*Fishes of the Tiber*

*Anguilla*

## FISH OF THE TIBER.

The fresh-water fish of the Tiber was held in little esteem by the ancient Romans. The only species mentioned by the poets of the Empire\* was the "Anguilla," or eel, which Juvenal describes as penetrating the sewers and fattening upon the garbage which it met with there. It was looked upon as inferior food, and the same poet represents it as set before the parasite, while the host regaled himself with the more delicate "Muræna":

Virroni muræna datur quæ maxima venit  
 Gurgite de Siculo.....  
 Vos anguilla manet longæ cognata colubræ  
 Vernula riparum, pinguis torrente cloaca  
 Et solitus mediæ cryptam penetrare Suburræ.—v. 99.

The fish most esteemed by the epicures of the city were those which were caught on the shores of the Mediterranean, or which occasionally ascended the Tiber from the open sea. Such were the "Rhombus," or turbot, the "Muræna,"† the

\* The perch is described by Ausonius, who lived in the early part of the fourth century, as a fish which might vie even with the red mullet:

Solus puniceis facilis contendere mullis.

But the perch is now, and probably always was, a stranger to the Tiber. Those of which Ausonius speaks were caught in the Moselle.

† Muræna is usually translated "lamprey," but, as the lamprey from the structure of its mouth is incapable of biting, it could not have been the fish by which the slave of Vedius Pollio was condemned to be devoured. Ovid describes the "Muræna" as

ardens

Auratis muræna notis.—Halieut. 26.

Whereas the lamprey has no such spots, and calls it "ferox."—Id. 113, 114. And Aristotle tells us that it feeds on flesh. On the other hand, the lamprey (Petromyzon) only sucks. Cuvier, therefore, supposes that the "Muræna" of the ancients was the same with the "Muræna Helena" of Linnæus, an eel-like

"Mullus," or red mullet, the "Acipenser," or sturgeon, and the "Lupus." In the time of Pliny a fish called the "Scarus," which cannot be identified with any modern species, was thought to bear off the palm; but the five which I have mentioned always maintained their reputation.\* The last two, the former of which is caught in the Tiber in modern times, the latter associated with it in ancient, will be treated of at greater length.

Everyone has read the story of Domitian and the turbot,† and of Vedius Pollio and the muræna, which he fed with delinquent slaves,‡ and every tyro in classics knows what enormous sums were paid for red mullets which exceeded the ordinary standard of size. From Horace, Pliny, and Martial we learn in what estimation the "Lupus" was held, while the flesh of the sturgeon was pronounced to be ambrosia, a food fitted only for the immortal gods, and one which, according to Martial,§ ought to be reserved for the table of Emperors. As the "Lupus," though now confined to the sea, ascended the river in the time of Horace as far as the centre of Rome, and as the sturgeon is still caught at the Ponte Sisto in the present day, the two may be considered as belonging to the

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animal which resembles the lamprey in its general appearance, but of which Cuvier himself says "that it bites severely," "Sa morsure est cruelle." (See Annotations of G. Cuvier to Pliny the Naturalist, x. 24. Ed. Pomba. Augusta Taurinorum. Turin.) It may be observed that the scientific name of the lamprey (*Petromyzon*) means "stonesucker," because it is fond of adhering to stones with its sucking mouth.

\* Next to these ranked the "Asellus," supposed by some to have been the haddock, by others the whiting, and the "Thynnus" or tunny. Of the former Ovid observes:

Et tam deformi non dignus nomine Asellus.—Hal. 131.

The latter were kept in large salt-water ponds, called "cetaria," and are thus referred to by Horace:

Plures annabunt thynni, et cetaria crescent.—Sat. ii. 5, 44.

† See Juv. Sat. iv. 72.

‡ The story may be found in Seneca de Ira. iii. 40, or in any classical dictionary.

§

Ad Pallatinas acipensem mittite mensas  
Ambrosias orment munera rara dapes.



Fig. 1

*Muræna of the Romans.*  
(*Muræna Helena*)

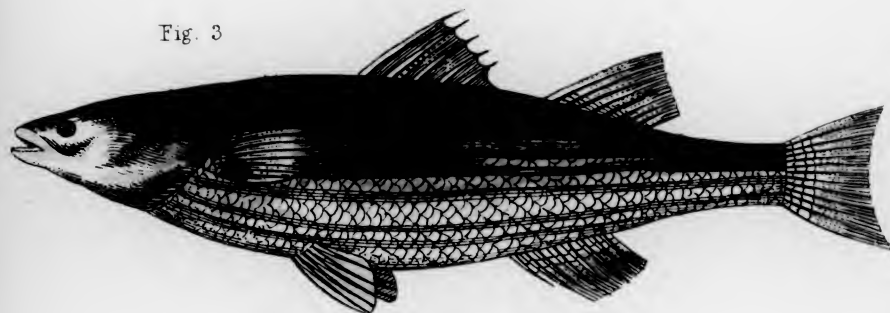


Fig. 3

*Mugilis of the Romans. (Mugil Cephalus.)*  
Grey Mullet.

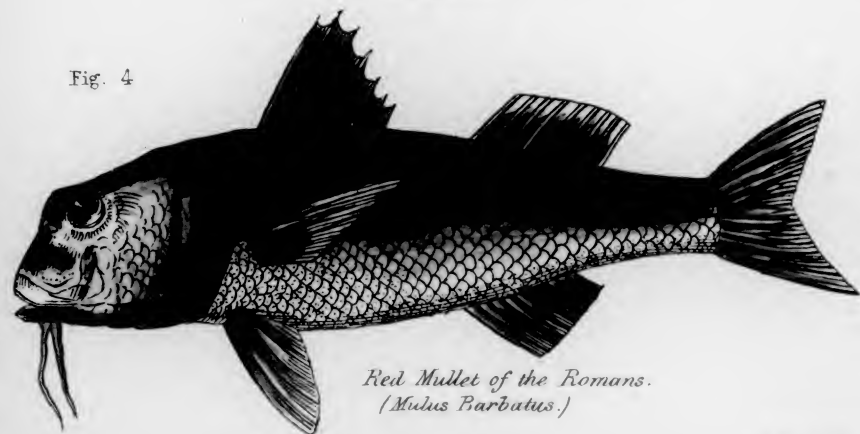


Fig. 4

*Red Mullet of the Romans.*  
(*Mulus Barbatus*)



Fig. 2

*Common Lamprey.*  
(*Petromyzon Fluviatilis.*)



Fig. 5

*Common Sturgeon.*  
*Acipenser for Acipenser Sturio.*

# Fishes of the Tiber.

Natural History of the Tiber and its classical associations, and, therefore, merit a longer description than the other fish, which were either fresh-water species held in little esteem by the ancient Romans, or salt-water species caught only in the open sea.

## THE LUPUS.

The "Lupus" appears to have ranked next to the "Muræna," the "Mullus," and the "Acipenser" for the delicacy of its flavour. The Roman epicures imagined that they could distinguish by the flavour not only whether the "Lupus" was caught in the Tiber or in the open sea, but even in what part of the Tiber it was taken, whether at Ostia or between the bridges:

Unde datum sentis lupus hic Tiberinus, an alto  
Captus hiet? pontesne inter jactatus, an amnis  
Ostia sub Tusci.—Hor. Sat. II. 2, 31.

Those taken in the heart of the city were preferred, as well as the "lanati" or "lanei," as they were called by Pliny and Martial, from the whiteness and softness of their flesh,\* the latter of which qualities would be no recommendation in the present day, when fish is valued in proportion to its firmness.

In many dictionaries, and even in Becker's "Gallus," the "Lupus" is mentioned as if nothing were known about it, except that it was a voracious fish, as its name would seem to imply, and some, who have not given their attention to the Natural History of fish, assume that it was the pike, which, from its greediness and fierceness, has received the name of the fresh-water shark. But the pike is an exclusively fresh-water fish, and is never taken, like the "Lupus" of the Romans, in the open sea or even in salt-water estuaries, though it is sometimes found in the inlets of the Baltic, which is far less salt than either the Atlantic or the Mediterranean, and in some places almost fresh.

\* *Luporum laudatissimi qui appellantur lanati a candore mollitieque carnis.*  
—Plin. IX. 61.

*Laneus Eugenei lupus excipit ora Timavi*  
*Æquoreo dulcis cum sale pastus aquas.*—Mart. XIII. 91.



There seems, however, no question about the identity of the "Lupus," and it is now recognised as the "Perca Labrax" of Linnæus, or the "Labrax Lupus" of Cuvier, a fish of the family of the perches, which grows to a much larger size and attains a much greater weight than the common perch.\* It is described as a fish of extraordinary voracity, which is accounted for by the large size of its stomach and the number of its coecums (a division of the intestines), which amount to five, while the fresh-water perch has only three. Though there is nothing repulsive in its appearance, and it has a superficial resemblance to the salmon, it has, from its boldness and voracity, received throughout the south of Europe names evidently derived from the Latin "Lupus," being called "Lupo" in Spain, "Loup" at Marseilles, "Luvasso" at Nice, and "Lupasso," though more generally "Spigola," at Rome. On the coasts of the ocean it is less plentiful, and it is called "Loubine" in some of the parts of Guienne. It is the "bar" of the coasts of Normandy and the "bass" of the English. Its usual length is a foot and a half, but individuals are not unfrequently found of two or, more rarely, of three feet. It seldom exceeds the weight of fifteen or twenty pounds, though Prince Bonaparte tells us he has weighed some of forty pounds.† On the other hand, it is rare to meet with a fresh-water perch of more than three pounds, though in the lakes Maggiore and Como they have been taken of six, eight, and ten pounds each.‡

The flesh of the "Labiæ" is very delicate, and is as much esteemed by the modern Romans as by their ancestors of the age of Augustus. The larger specimens are eagerly bought up by the wealthy Romans, and exhibited with pride at their feasts.

The "Spigola" is taken in large numbers on the shores of the Mediterranean, and in less quantity on the coasts of Normandy and England. According to Athenæus it was greatly

\* Histoire Naturelle des Poissons, by Baron Cuvier and M. A. Valenciennes. Paris, 1836.

† Fauna Italica, by Carlo. L. Principe Bonaparte, Principe di Canino.

‡ These would, of course, be Roman pounds.

esteemed in Greece, where it was known by the name of λάβραξ, which is evidently derived from the λαβρότης, or voraciousness of the fish.

#### THE STURGEON.

The capture of the sturgeon, according to Pliny, was a rare event,\* and its excellence was perhaps overrated on that account. In Athenæus we have a description of an Attic supper in mock heroic verse, which doubtless represents the tastes of the Romans of the time [A.D. 230]. The description is supposed to be given by Matron, a *πρωτόδωρ* or composer of burlesques. Matron tells us that, though he had already eaten a hearty supper, he could not restrain his impatience to taste the sturgeon, which, according to the usual practice, was introduced in state, and that it seemed to him "ambrosia," food fitted only for the immortal gods.†

To us it does not appear to deserve the praises bestowed upon it by the ancients; the flesh, at least in the larger fish, being dry, and resembling coarse veal more than anything else.

The sturgeon is taken in the Tiber of every size, from eighteen inches or less to twelve feet or more. It ascends the river in the month of May, and is caught from that time to the end of June. Large fish, weighing from one hundred

\* Nullo nunc in honore est, quod quidem miror, quum sit rarus inventu. Plin. ix. 60. But what he says about the sturgeon being less esteemed than formerly is contradicted by the verses quoted from Martial, who lived at the same time as Pliny.

† Τῶν δ' ἄρ' ἔλωψ κρείων δονρικλυτός ἡγεμόνευεν  
Οὔ, πλήρης πῖρ ἰὼν, κρατερὸς παλάμη ἐπορίχθην  
Γεύσεσθ' ἱμεύων, τὸ δὲ γ' ἀμβροσίη μοι ἰδόξεν  
'Εἶν, ἣν δαίονται μάκαρες θεοὶ αἰὲν ἰόντες.—IV. 5.

The sturgeon led them warrior prince renowned,  
Although already sated with the feast,  
Eager to taste it forth I stretched my hand,  
And seized a portion in my sturdy grasp.  
Methought it seemed ambrosia, food for gods,  
Such as immortal gods alone may taste.

The sturgeon was brought in first in the procession of dishes.

to three hundred pounds, are entangled occasionally in the revolving nets at the Ponte Sisto, which are intended principally for the capture of shad, and called "giornelli," because all day long they never cease to turn. When this takes place, the revolution of the net is arrested by the weight of the fish, which is secured by means of a boat.

The larger sturgeons, of which not more than thirty or forty are taken in a year, are, of course, considered great prizes; but the flesh of the smaller ones, called by the Romans "porchetti," or sucking-pigs, is far more delicate than that of those which attain the dimensions I have stated, while it is sufficiently firm.

The sturgeon has always been considered "a dainty dish to set before a king." I have quoted the lines of Martial in which he recommends a sturgeon to be sent to the Palatine, as its only fitting destination; and in modern times, the sturgeon, when caught in the Thames, within the jurisdiction of the Lord Mayor, is considered a royal fish. The king appears, however, to possess the same claim to the fish when caught anywhere within the British Isles. In the "Times" of the twenty-ninth of May, 1872, there appeared a letter from a fishmonger of King's Lynn, Norfolk, complaining that the superintendent of police and two officers had called at his shop and carried off a sturgeon of fifty or sixty pounds, saying that it ought to have been offered to the Mayor (to be presented, I presume, to the Queen). In the same Journal, of the twenty-first of July, in the same year, appeared the following paragraph, headed: "A Royal Fish.—On Friday morning a sturgeon, six feet six inches long, weighing about one hundred and twenty pounds, was caught in the Medway, opposite Chatham dock-yard. The Mayor of Rochester sent the fish to the Queen, at Windsor, by the principal water-bailiff of the city, Mr. E. G. Watson." It does not appear whether any compensation was made either to the Lynn fishmonger or to the captor of the sturgeon at Chatham.

As the sturgeon in England was considered to belong of right to the king, so one which was taken in the revolving

nets at the Ponte Sisto was thought a fitting present for a Pope. It was the year 1848, and Pius IX. was in the height of his popularity. The sturgeon, which was between seven and eight feet in length, was put alive into a large vessel of water, placed upon a frame decorated with green boughs and flowers, and carried in procession by six boatmen dressed in white, and wearing scarlet caps. This happened during the Easter festival, at the time of the Apostolical supper, and a large portion of the sturgeon is said to have been distributed among the men who represented the twelve apostles.

The sturgeon belongs to the order of cartilaginous fishes, or those with gristly instead of bony skeletons. It is, therefore, allied to the shark, which, in some parts of its structure, it resembles. As in the shark, the mouth is underneath, while the long snout, where we should expect the mouth to be, is undivided. In other respects nothing can be more different than the two fishes, the mouth of the sturgeon being small, toothless, and protractile, so that it is incapable of feeding on anything but small animals and soft substances.

#### THE GREY MULLET.

Though the grey mullet, "*mugilis cephalus*," is properly a fish of the sea, yet, as it is caught at the mouth of the Tiber, and is mentioned by Juvenal as the instrument of punishment for a certain class of offences,\* it will not be out of place to give its history here.

The flesh of the grey mullet, which is commonly sold in the markets of Rome, is firm and delicate, and fully equal to that of the "Lupus," or "Spigola;" yet it does not appear to have been held in the same estimation by the ancient Romans, who gave such enormous sums for the red mullet, a fish nearly allied to the grey. The beauty, however, of the red mullet appears to have been its principal recommendation, for it was often brought in alive at a banquet, in order that

\* ..... quosdam moechos et mugilis intrat.—x. 317.

the guests might feast their eyes with the changes of colour which it exhibited as it expired.

The "*Mugilis cephalus*," so named from the large size of its head, and called by the Italians *cefalo del Mare*, is one of the largest of the genus. Specimens are often seen, which are eighteen inches long, and some have been found which measured two feet or more. It attains the weight of ten, twelve, and sometimes, according to Prince Musignano, seventeen pounds.

Modern observation has confirmed the accounts which the ancients have given us of the sagacity and extraordinary activity of this fish, which has led fanciful Etymologists to derive the name "*mugilis*" from "*multum agilis*," "very active." On calm and moonlight nights they may be seen at Civita Vecchia amusing themselves by leaping out of the water, splash succeeding splash in rapid succession, so that listeners have imagined that persons on shore were throwing stones into the sea. Pliny asserts that they have been known to leap over a ship; but of what size is not stated. Even under the sun of India the grey mullet retains its peculiarities. For the correspondent of the "*Times*," who accompanied the Prince of Wales, while sailing in an open boat along the coast south of Bombay, observed a species similar to, or identical with this, continually jumping out of the water. One leapt into the boat, and another would have followed if it had not been arrested by an arm.

When many are caught in a net, it is necessary to close it as quickly as possible at the top, otherwise they will all jump over it and escape.

The foremost dorsal fin of the mullet is furnished with four rigid spines, which lie flat when the fish is moved in the direction of its head, through an opening a little larger than itself, but which erect themselves when it is attempted to withdraw it. It was thus used by the Romans to lacerate the tenderest parts of the human body, as a punishment for the crime of adultery.

## THE EEL.

The eel is in much higher favour with the people of Rome in the present day than in the time of Juvenal, when, as we have seen, it was banished to the table of the parasite. It is now considered as excellent food by people of every class; but the eels caught in the Tiber form but a very small part of those which are consumed in the modern city. The main supply comes from the lagunes of Comacchio, near the mouth of the Po, and communicating by a channel with that river. The eels, according to Spallanzani, retreat to the lagunes immediately after their birth, and at the end of five years they return to the Po. At the period of their return the fishermen of the Comacchio form small chambers with reeds, in which they are caught, and in which they collect in such numbers that they may actually be seen above the surface of the water. Pliny\* describes them as taken in his time in similar chambers [*excipulis*], at the point where the river Mincius issues from the lake Benacus, and says that as many as a thousand have been caught in one of these.

As soon as the eels are taken out of the water they are cooked, and after being cut into pieces are packed in barrels with a certain proportion of vinegar, and sold in Rome, Naples, and the principal cities of Italy. The larger specimens, distinguished by the name of "*capitone*," are preserved alive in enclosures, similar to those which have been described, and sent during the month of November and December to Naples and Rome, where they are highly relished by people of every grade, and where, on the day before Christmas, "*capitone*" forms a standing dish in every Italian family.

In the utilization of the eel as an article of food the British may learn a lesson from the Italians. Frank Buckland, in the "*Times*," twenty-first of September, 1872, expresses his surprise that the Scotch salmon fishermen allowed the eels to pass them during the period of their annual migration (the middle of

\* Plin. Hist. Nat. IX. 21 (38).

September to the end of October) from the lakes and rivers to the sea, without any attempt to catch them. It appears that the Scotch have a prejudice against the eel, and would as soon, Buckland observes, eat a viper or boaconstrictor. But why, he says, should they object to catch and sell them where they are highly relished, as in London and other places. He then goes on to describe his visits to various eating-houses frequented by the poor, where stewed eels formed the staple dish. He found them, he says, extremely savoury, and, with the sauce, well worth the twopence he paid for his portion. He regrets, therefore, that at a time when there are so many complaints of the dearness of living, so much nutritious food should be thrown away by prejudice or carelessness.

## THE TENCH.

The tench, "*Tinca vulgaris*," is a fish that luxuriates in mud, in which it is supposed to bury itself during the winter, for it is rarely caught at that season. The Tiber, therefore, would seem to be a habitat peculiarly suited to its tastes. But, if it loves mud, it loves still water yet more, and is seldom found except in lakes and sluggish streams; those brought to market at Rome are usually caught in the lake of Visco and others which discharge themselves into the Tiber; those taken in the river itself being supposed to be swept into it when the streams which issue from the lakes are swelled by rain.

The flesh of the tench was held in little repute by the ancient Romans. Ausonius speaks of it as a fish which none but the coarse appetites of the common people could relish.

*Quis non et virides vulgi solatia Tincas  
Novit? Auson.*

Ausonius lived, indeed, A.D. 410, and the taste in fish may have undergone a great change since the time of Augustus; but there is no reason to suppose that the tench was a favourite with the Romans at any time. By the modern Romans it is relished as little as by their ancestors. It is

thought to have a flavour derived from the mud in which it delights to wallow, and it requires, as the Romans think, to be dressed the very day on which it is caught. In England, also, its flesh is underrated, as Yarrell considers, and he recommends it as one of the most useful fish for stocking ponds.

The fish above described are those which are mentioned by the poets or natural historians of Rome; but some of the species taken in the Tiber in the present day, and used as food by the inhabitants of the city, cannot be identified with any that are noticed by ancient writers. These species are few in number compared to those which are caught in the Thames, some of which appear to have been artificially introduced. The salmon, being a stranger to the Mediterranean, is, of course, unknown in the rivers which flow into that sea; the tunny, a fish which never ascends rivers, supplying its place as an article of luxury and trade. The perch and the trout\* also are wanting in the Tiber, and even the pike and tench are extremely scarce. When taken in the river, they are supposed to have been washed down by the floods from the small lakes which empty themselves into it and where they are usually caught. The most abundant fish appear to be the barbel and the shad when in season. If to these we add the river lamprey, a species of carp called by the Romans "*Regina*," a species of dace to which the name of "*Squaglio*" is given, and two varieties of eel, the list of species will nearly be complete. Of these, the most important or the most interesting from their natural history, are the shad and the lamprey, and a short account of these will be given.

\* These remarks apply only to the Tiber between the sea and the junction of the Nera, a distance of about eighty-five miles by the windings of the stream. But high up the tributaries of the river, at and above Tivoli and the falls of Terni, and wherever the affluents flow with a clear current over a rocky or pebbly bottom, the angler may find the trout.



## THE SHAD.

The shad, "*Clupea alosa*" (Italian "Laccia"), is a fish of the family of the herrings, which it resembles in everything but size, the usual length being eighteen or nineteen inches and weight four pounds and a half, while some attain the length of two feet and weigh eight pounds. The "Laccia" ascends the Tiber in the early part of the summer, and is caught in large numbers in the revolving nets of which I have spoken. This is the cheapest fish at Rome during the time when it is in season, and its flavour is delicate; but it abounds in small bones, like its congener the herring, which it resembles in taste and in the oiliness and texture of its flesh.

## THE LAMPREY.

The lamprey, though confounded by the moderns with the "Muræna," does not appear to have been mentioned by any of the Latin writers. In the present day it is rarely seen in the markets of Rome, and forms but an inconsiderable part of the food of the people. Its associations, also, are with the death of an English king rather than with classical literature. Yet as one species, the "*Petromyzon fluviatilis*," is found in the Tiber, a place must be given it in the fauna of that river. The lamprey is worthy of notice, likewise, on account of the peculiarity of its respiratory system. Seven round holes, disposed in a line on one side of the neck, admit the water, which is expelled through an opening at the top of the head, and issues from it in a little spout. It is thus enabled to breathe while it adheres to stones or other objects with its circular mouth.

It is remarkable that neither the perch nor the gudgeon, "*Cyprinus Gobio*" or "*Gobio fluviatilis*," the little fish so plentiful in the fresh waters of England, and so easily caught that the name of gudgeon is applied to a simpleton, who allows himself to be easily entrapped, is found in any of the rivers of central Italy. Of the perch, "*Perca fluviatilis*," Bonaparte, Prince of Canino, observes: "Niun Percha d'acqua dolce si conosce in questo piccolo angolo della terra che

e Roma, ne in tutta la parte meridionale dello stato" (that is, in the states of the church south of the Apennines, as distinguished from the Romagna).

Professor Diorio remarks that owing, perhaps, to the poisoning of the water by the refuse from the gas-works, there appears to be a line of demarcation between the fish of the upper and lower Tiber, which neither is able to cross. It is owing, perhaps, to this and other causes that the "Lupus" no longer ascends the river to the heart of Rome, to prey upon the garbage, which imparted to it the flavour so much admired by the epicures of the time of Horace, and that, even at Ostia, only small specimens, called "Spigoletti," diminutive of "Spigola," are said to be taken at the present day.

In addition to those which I have mentioned before, the common carp ("*Cyprinus Carpio*"), the golden tench ("*Tinca Chrysis*"), and the "*Tinca Italica*" (rare), are occasionally taken. A small fish, also, of which there are three species, the "*Laterina Hepsetes*," the "*Laterina Lacustris*," and the "*Laterina Sardica*," is caught in great abundance, and considered a delicacy. It is from an inch to an inch and a half or more in length, and is eaten whole.



## THE OTTER.

The solitary habits of the otter and its peculiar instincts explain why it is so little known except to those who go to seek it, and why its existence is often unsuspected in places where it is tolerably abundant. Like the kingfisher, it confines itself to the streams where it was born and reared, and where it has been in the habit of fishing, and rarely crosses from one river to another. Its retreat, also, is concealed in a most ingenious manner. The otter always forms an entrance below the surface of the water and works upwards, hollowing out one or more chambers. The hole for the admission of air is made to open beneath a bush, so that there is no external indication of the presence of the animal.

As might have been expected from the unobservant nature of the Romans and the difficulty of discovering the otter's retreat, it is impossible to learn anything certain respecting it from the natives of the town; and as the cruel amusement of otter-hunting has not yet been introduced into Rome, there is no inducement to ascertain its haunts or to learn whether it exists at all. Even the Professor of Zoology could not say whether otters are found on the Tiber above the city, though he had heard that they were occasionally seen between the city and the sea. In fact, the Tiber between Rome and its source is a terra incognita to the Romans, almost as little explored as the Congo in its upper course, and any information regarding its Natural History must be gleaned from English sportsmen and French savants. Accordingly, we are informed by Bonaparte, Prince of Canino, that the otter is met with in the marshes of Ostia, upon the borders of the Anio, along the banks of the Tiber, and sometimes even within the walls of Rome.

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The otter furnishes another instance of the extreme carelessness and ignorance of Pliny in all matters relating to the Natural History of animals. The *ἐνὕδρις* (or animal dwelling in the water) of Aristotle was a quadruped identical with our otter; the "enhydriis" of Pliny (a Latin translation of the Greek) was a species of snake or fish. Pliny, or his informant, had probably seen the head of the swimming otter, and mistook it for that of a snake or fish, just as the head and shoulders of a large seal appearing above the surface of the waves, has given rise to the fable of the sea-serpent.

The destructive habits of the otter have, I believe, been greatly exaggerated, owing to the desire which exists among the vulgar herd to seek in the supposed noxious qualities of the animal an excuse for persecuting it. It is said to destroy many fish at a time, devouring only the head and shoulders. This may be the case when the animal is allowed to work its will in a well-stocked fish-pond, but it is absurd to suppose that a hungry otter, which has just caught a fish in a river, would leave the greater part of it untasted and go to hunt a fresh one. Were the instinct of destruction as great as is represented, the vicinity of an otter's hole ought to be a complete charnel-house for fish bones and the remains of fish, and would infallibly betray its whereabouts, but I am not aware that such a sight has ever been observed.

The otter when taken young may be tamed, and become as familiar as a dog, though it is said that it can never be taught habits of cleanliness.

In the journal of Bishop Heber is the following interesting account of the otter, which has been domesticated in the East. This is a distinct species from our own, and is thought to be the "Lutra Nair" of Cuvier. "We passed," says this benevolent prelate, "to my surprise, a row of no less than nine or ten very large and very beautiful otters, tethered with straw collars and long strings to bamboo stakes on the banks of the Malta Colly (one of the numerous branches which intersect the Delta of the Ganges). Some were swimming about to the full extent of their strings, or lying half in and

half out of the water; others were rolling themselves in the sun on the sandy bank, uttering a shrill whistling noise, as if in play. I was told that most of the fishermen in this neighbourhood kept one or more of these animals, which are almost as tame as dogs and of great use in fishing, sometimes driving the shoals into the nets and sometimes bringing out the larger fish with their teeth. I was much pleased and interested with the sight. It has always been a fancy of mine that the poor creatures which we waste and persecute to death, for no other reason than the gratification of our cruelty, might, by reasonable treatment, be made the sources of abundant amusement and advantage to us."

The kind-hearted Bishop is one of the few who do not regard with indifference the cruelties practised upon animals in a state of nature, or think it an unmanly weakness to feel for their sufferings. The allusion is, of course, to the cruel and cowardly amusement of otter-hunting, or, as it might with more propriety be called, otter-baiting; for what is the difference in principle between otter-hunting and the baiting of bulls and badgers, now happily proscribed by law. If there be any difference, otter-baiting is the more cruel and *cowardly* sport of the two, because the otter is placed at a greater disadvantage by the number of its assailants.

It has been urged in defence of fox-hunting that it is conducive to health, and that the galloping across country is a good training for cavalry officers in time of war; but what incidental benefits are derived from standing on the banks of a river or walking a short distance along it to see an unfortunate animal battling against a whole pack of hounds, and, being nearly suffocated by constant diving and lacerated by scores of wounds, succumbing at last to the multitude of its enemies.

It might be expected that a naturalist would sympathise with the animals whose habits he has studied, and with many of whom, if of a kindly disposition, he would have formed a sort of friendship; yet Dr. Bell, in his "History of British Quadrupeds," describes an otter-hunt, and details all its bar-

barities with the unction of one whose life had been devoted to the sports of the field. He writes, not only as if he himself saw nothing wrong in the amusement, but as if it never entered into his head that anyone could object to it on the score of cruelty.

Humanity to animals is a virtue of very recent date. There is no trace of it, as a principle, in the ancient writers, though individuals are recorded to have had their pets,\* and it is not enforced in the New Testament. Hence a large portion of those belonging to the so-called religious world display little sympathy with the sufferings of animals, and contribute nothing to the society for their protection, as if cruelty to animals, though not forbidden "*totidem verbis*" by Christ and his disciples, any more than slavery or polygamy, were not contrary to the spirit of the Gospel.

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\* Catullus has immortalised the sparrow of Lesbia; Hortensius, the orator, was so attached to a tame *muræna*, which fed from his hand, that he is said to have shed tears when it died [Pliny ix. ch. 81 (55) and Macrobius, Saturnalia]; and the Britons, Cæsar tells us [de Bel. Gal. v. 12], did not taste the flesh of the hare, the common fowl, or the goose, but kept them for amusement, "*animi causa*." To Virgil the slaying of a pet stag is fabled to have been the art which first aroused the Latins to take up arms against the Trojans.

## SEARCHING THE BED OF THE TIBER FOR WORKS OF ART.

It may be expected that some notice should be taken of the speculation which some years ago engaged the attention and raised the hopes of the Roman archæologists, and from which such great results were looked for—the recovery, namely, by dredging, of the works of art which are popularly supposed to be entombed in the mud of the Tiber.\* On the subject of these treasures, whose existence rests on traditions as apocryphal as the story of the golden candlestick, I have collected, I believe, all that can be said; but previously I will notice the extraordinary conclusion at which Preller, in his “*Rom und der Tiber*” arrives: “that experience, and the repeated researches of practical men, have shown that this notion (that the bed of the Tiber contains large treasures of art) is either altogether unfounded or at least greatly exaggerated. Both these engineers (Fea and Linotte) point out, that the fall of the bed of the river is sufficiently great, the current of the river itself within the city sufficiently strong, to sweep away in course of time every object cast into the stream.” In this sentence there is great confusion of ideas. If every object of art has long been swept away, there can be no question of more or less, and no room for exaggeration. But, letting this pass, is it not strange that the engineers, whose authority Preller quotes,† who have the reputation of

\* With regard to the statues said to have been flung from the castle of St. Angelo on the heads of the besiegers, it has been well observed, that the attack would naturally have been made on the side unprotected by the Tiber, and, consequently, that the statues would not necessarily have found their way into the bed of the river.

† Let Fea and Linotte speak for themselves: “*il corpo di acqua del Tevere*,” they say: “*sia di tal forza da poter promuovere le materie mescolate alle sue acque fino al mare, anche con minor pendenza di quella che ha presentemente.*”

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being men of science, should form such an erroneous estimate of the power of running water as to suppose the current of the Tiber capable of transporting statues of marble and of bronze.

Vallès, the engineer in chief of the Ponts et Chaussées, maintains, on the contrary, that rivers in their course through the plains are incapable of transporting even gravel, and that the gravel which is found in their beds has not been carried from the hills in which they had their source, but is derived from the banks in the immediate neighbourhood.\* Now, as the transporting power, *ceteris paribus*, is proportionate to the surface, which increases as the square, while the weight to be moved is proportionate to the solid content, which increases as the cube, we may see the absurdity of supposing that a river that could not move gravel would have the power to transport masses of stone. Only when the declivity of a river is measured by tens of feet in a mile, has the stream sufficient force to overcome the friction of a large body, and set it in motion. Nor is the power of transporting objects lying at the bottom of a river augmented during floods. The increased velocity of a swollen river is due to the hydrostatic pressure of the water above, and extends to a depth equal to the rise of the river. It is no more sensible at the bottom than the motion of the waves beyond a certain depth.† The Tiber, when flooded, deposits

\* Vallès, *Etudes sur les Inondations*, chap. Force de transport des fleuves.

† The following are some of the superficial and mean velocities of rivers in the plains, as ascertained by experiment. They are extracted from a larger number given by Vallès:

Velocities of Surface.	Mean Velocities.
2.100	1.580
1.400	.798
1.450	1.004
2.224	1.518

The corresponding minimum velocities, or those near the bottom, would be 1.060, .196, .558, .812. It appears from this that, when the fall is inconsiderable, a great difference may exist between the velocity at the surface and that at the bottom, upon which the transporting power of rivers depends; though as the declivity increases, the ratio of the bottom to the surface velocity approaches to a ratio of equality, the transporting power is increased, and at the same time a

large sand banks, not only in sheltered nooks, but in spots where the banks form a straight line, and sloping from the sides towards the centre of the stream, showing that the bottom is comparatively tranquil. These sand-banks are cut through and swept away when the river sinks and the superficial velocity reaches them.

We may, therefore, assume, that whatever works of art, incapable of much damage from water, were committed to the Tiber have been intrusted to safe keeping, and might remain there to the day of judgment, or at least to the next geological convulsion, for all that the Tiber can do to remove them. This being granted, we will consider the probability of works of art having fallen into the river by accident, or been thrown into it by design, and left there by those who had neither the opportunity nor the inclination to attempt their recovery.

Most students of archæology are aware that there is no novelty in the idea of dredging the Tiber in the hope of discovering some statue, or object of antiquarian interest, which chance or design had committed to its depths, and that similar schemes have been broached from time to time in the course of the last two or three hundred years. The President de Brosses, who visited Italy during the Pontificate of Benedict XIV. (1740), tells, in his letters, the apocryphal story of an offer made by the Jews to excavate and clean out the bed of the Tiber, provided they were allowed to appropriate all the treasures and objects of antiquarian interest which they met with in the course of their operations. The offer was declined, it is said, because it was feared that the stirring up of the mud would create a pestilence in the city.

This story is thought by Fea\* to have been palmed upon the President by a Roman cicerone; but whether true or false,

body resting on a steeper inclined plane is moved with greater ease. It is evident, therefore, when we consider the slight declivity of the bed of the Tiber, and the large amount of friction to be overcome, that no conclusion can be drawn from the swiftness of its current in time of floods as to its power of transporting heavy objects resting on its bed.

\* Fea *Novelle del Tevere*.—Roma, 1819.

it shows that the attention of the Romans of the time was directed to the subject. Nevertheless, either owing to the want of funds, the unfavourable report of the engineers, or the disappointment of the Pope, no attempt was made to carry the design into execution, and after having amused the city for a time, it was dismissed entirely from the thoughts of men.

We hear next of the matter in the early part of the present century, when Georgina, Duchess of Devonshire, after trying in vain to procure permission for herself, or a company which she represented, to divert the course of the Tiber, determined to dredge the river at her own expense. She appears, however, to have met with nothing to reward her pains, or to repay any portion of the money sunk in the venture.

Shortly before 1819 the dredging of the bed of the Tiber had again become the subject of conversation, and "opinions," says Fea, "were revived, which good sense, and a more accurate knowledge of history and topography, had cast into another river, that of Lethe, and it might have been hoped into eternal oblivion."

This time, also, nothing appears to have been done, and the project slept for five-and-forty years, when an association was formed for the purpose of carrying out a scheme so often projected and so often abandoned. Mr. Lecky undertook to be the medium of communication with the government, and having procured an interview with Cardinal Antonelli, explained to him that it was proposed to divert the course of the Tiber, and thus to recover with greater ease the objects of art supposed to be lying in its bed. The same objection was made by Cardinal Antonelli which had been raised against similar propositions in former days—that the stirring up of the mud of the Tiber would breed a pestilence in the city during the heats of summer. The plan was thus nipped in the bud, and nothing more was heard of it until the year 1870. There is a general impression that a new association was formed at that date with the sanction and approval of the Italian government. It appears, however, that the present society is nothing but a resuscitation of the old association, whose members



hoped to obtain from the more liberal ministers of Victor Emmanuel the permission which had been refused by the government of the Pope.

I am unable to learn whether the society has done anything towards carrying out the object with which it was formed. The "dolce far niente" seems to influence every proceeding of the Italians, whether they act separately or in masses, so that it is impossible to say whether the society has abandoned its design or is merely taking its siesta.

The belief that countless works of art are imbedded in the mud of the Tiber appears to be based, partly on the alleged vandalism of Gregory the Great, and partly on the stories of statues and other precious objects cast into the river in order to preserve them from destruction by the enemies of Rome. It is said that Gregory, in order to withdraw from the sight of the pilgrims who resorted to the Eternal City every object of profane curiosity, caused the statues and other sculptures of the Gentiles, as he called them, to be removed from the public edifices and cast into the Tiber.

With regard to the objects of art thought to have been consigned to that river as a place of security, the belief rests only on tradition, which itself was, probably, based on a presumption of how people were likely to act in times of terror and insecurity; though, as the author of a letter in the "Times," the third of May, 1872, well observes: "when people wish to conceal their property either from foreign invaders or domestic revolutionists, they are more likely to bury it in the earth than to consign it to the depths of a river, whence its subsequent withdrawal may be difficult," or, we may add, impossible.\*

Fea examines at length the charge against Gregory, and shews the improbability of its truth. The story is found in no contemporary record, and appears to have been propagated

\* There is a record of one statue, at least, having been thrown into the Tiber, though with an object very different from that of which we are speaking. We refer to the statue of Isis, mentioned in a former chapter.—"Superstitions connected with the Tiber."

both by friends and by enemies; by fanatical friends, who admired his religious zeal, and by free-thinking enemies, who thought to satirise his narrow fanaticism and absence of taste. Yet Gregory was of an illustrious senatorial family, and a man of cultivated intellect. It is unlikely, therefore, that he would have been insensible to the beauty of the works of art which he is accused of having consigned to oblivion. Before he became a monk he had been Prætor Urbanus, or Prefect of Rome, to which dignity was attached the office of "Curator of the bed and banks of the Tiber," and, by the terms of that office, he was bound to attend to the channel of the river and to keep it free from every kind of obstruction. There had been a destructive inundation in the November of the year 589, preceding his election, followed by a pestilence, which was attributed by many to the inundation. It is, therefore, highly improbable that by casting such a number of statues into the Tiber he would have impeded the navigation of the river and increased its liability to floods, attended, as they were, by consequences so disastrous to the city.

The legend, also, of Gregory's admiration for the monuments of the Forum\* of Trajan and for the character of that Emperor, which led him to be the means of releasing his soul from hell,†

\* This was in perfect preservation in his time, A.D. 590, and there the poets of the day used to meet and recite their verses or those of the standard poets of antiquity. In Venantius Fortunatus, Bishop of Poitiers, a contemporary of Gregory, we have the following lines:

Vix modo tam nitido pomposa poemata cultu  
Audit Trajano Roma verenda Foro.—Car. III. c. 23.

We are not informed whether these "pompous" poems were the immortal productions of Homer and Virgil or the forgotten compositions of those that recited them.

† The story is told by Paul the Deacon from the Saxon Ecclesiastical Chronicles, where alone it is to be found. "Gregorius cum quadam die per Forum Trajani, quod opere magnifico constat esse extractum, procederet, et insignia misericordiæ ejus conspiceret, interque memorabile illud comperiret, videlicet." &c.—Vita. S. Gregorii, sec. 22. Paul goes on to tell the story of a widow, which appears either to have been suggested to Gregory or recalled to his recollection by a group of figures in the Forum. Trajan, when mounted on horseback and ready to start for the seat of war, is stopped by a widow, who



appears to be inconsistent either with the want of taste or with the religious fanaticism attributed to him.\* Besides, he could not have taken so decided a step without the permission of the Emperor Maurice, who reigned at Constantinople, of which Rome was then a dependency, and he must have confronted the indignation of the people, who took a pride in the works of art with which their city was adorned.

Of the number of statues existing half-a-century before his time, we have evidence from many sources. Among the manuscripts brought to light by the late Cardinal Mai is one in Syriac, which bears the name of Zacharias, Bishop of Melitene, in Armenia, who lived in the sixth century, and who is surnamed "Rhetor," to distinguish him from Zacharias, Bishop of Mitylene, who lived at the same time, and is generally known by the name of "Scholasticus." The document in question consists of a series of tracts upon miscellaneous subjects, and is followed by another in the same language, which describes the streets, the public buildings, and the works of art of Rome.

entreats him to do justice on the murderers of her son. Trajan pleads haste as a reason for declining her request, and promises to hear her case when he returns. "But, suppose you never return," said the widow. On this Trajan dismounted, and, after enquiring into the truth of her story, inflicted due punishment on the guilty.

John the Deacon, in relating the same story, prolongs the conversation somewhat, and puts a more cogent argument into the mouth of the widow. "Suppose you never return," says she. "Then my successor will see you righted," replied Trajan. "But is it not better," rejoined the widow, "to perform the good action yourself, and thus gain all the credit both in this world and in the next?" The argument appeared conclusive to Trajan, and he dismounted, &c.

The sequel of the story is better known: that Gregory was moved to tears by the thought that so good a man should be doomed to eternal torments, and prayed fervently for him. In the evening he fell into a trance, and was informed by a voice from heaven that his prayer had been heard and the soul of Trajan released from hell, but that he must never again presume to intercede for an unbaptized infidel.

\* The legend, as I have before observed, is found only in the Saxon Chronicles. Gregory was an especial favourite with the Saxons, whom he had been the means of converting to Christianity, and the legend was, perhaps, invented by them for the purpose of doing him honour.

Mai, who translates the other tracts into Latin, gives no version of this, assigning as a reason his belief that it was not the production of Zacharias.\* In Ampère's "History of the Roman Empire"† the most remarkable passages of this treatise are quoted, but nothing is said about the language in which they were written, nor does Ampère tell us whether he translates directly from the Syriac or copies the translation of another. He is silent, also, upon the doubts of the authenticity of the tract expressed by Cardinal Mai. Not being a Hebrew scholar myself, I will give from Ampère the passages relating to the works of art, without vouching for the authenticity of the original or the correctness of the translation.

According, then, to this author, whose identity with the Bishop of Melitene is matter of dispute, there were in Rome, at the time when he wrote, eighty great statues of gold (that is, statues plated or gilded with gold), sixty-six ivory statues (or statues veneered with ivory) of the gods, three thousand seven hundred and eighty-five bronze statues of emperors and other generals, twenty-two equestrian statues in bronze and two colossuses.

But, if this authority be looked upon as apocryphal and suspicious from its very preciseness, we have testimony more unimpeachable in the writings of Cassiodorus, the secretary of Theodoric, who lived about the same time, and in the city, whose wonders of art he is describing. I refer to his well-known saying that the number of statues in Rome was so large that they seemed almost as numerous as the living population.‡

\* Sequuntur autem ibidem, in miscello scilicet codice, alia quædam de originibus et ædificiis Romæ, quæ Syriace quidem edidimus, sed Latine non fecimus, quia Zachariæ foetum non existimavimus.—Mai. vol. x. of his works under letter Z. index.

I have thought it necessary to enter into these details, because there are many who neglect to give references, or withhold all information regarding the authorities which they quote.

† L' Empire Romain à Rome, par J. J. Ampère, tom. II. pp. 407, 408.

‡ "Has (statuas) primum Tusci in Italia invenisse referuntur, quas amplexa posteritas præne parem populum urbi dedit quam natura procreavit."—Cassiodorus, Variorum, Lib. VII., Formula xv. ad Præfectum Urbis de Architecto faciendo.

If, then, there is no reason to believe that these statues were cast wholesale into the Tiber by Gregory, or singly by individuals, the question arises in what manner have they disappeared? The bronze statues were, doubtless, melted down for the sake of their material. That many were burnt for lime by the same modern barbarians, who built their houses with stones taken from the Colosseum, has long been known, but additional light has been thrown upon their fate by recent discoveries. In a lecture delivered in 1869 by Mr. Shakespere Wood, before the British Archæological Society, some interesting details were given on the subject. Mr. Wood mentioned that since the middle of the last century several of these lime-kilns have been discovered (one by Signor Rosa, in the excavations on the Palatine), with fragments of statues wilfully broken lying around them. He stated, also, that there was historical evidence to shew that the districts likely to prove fruitful in the remains of sculpture were let out to lime-burners, especially at Ostia and at Adrian's Villa.

In the latter part of the fifteenth century this destructive process was arrested by the reviving taste for the arts, and

"The Etruscans are said to have been the first people who invented these statues, and posterity adopting (a taste for) them has given the city almost as large a population as nature has begotten."

In another passage of the same section, Cassiodorus enlarges upon the beauty of these statues: "*videbit profecto meliora quam legit, pulchriora quam cogitare potuit, statuas illas auctorum suorum adhuc signa retinentes...ut quam diu laudabilium personarum opinio supereset tam diu et similitudinem vivæ substantiæ imago corporis custodiret...mirabitur formis equinis signa etiam inesse fervoris. Crispatis enim naribus ac rotundis, constrictis membris, auribus remulsis, credet forsitan cursus appetere, cum se metalla noverit non movere.*" "Assuredly, he will see things more excellent than he has read of, more beautiful than he could have conceived; those statues, namely, still retaining their sculptors' mark...so that as long as the fame of distinguished persons survived, so long the image of their body might retain the likeness of their living substance...he will be astonished at the expression of fire in the figures of horses, and while he beholds them with curled and rounded nostrils, with limbs drawn close together, and with ears thrown back, he will, perhaps, imagine that they are eager for the course, though he is well aware that metal is incapable of motion."

This was written about three-quarters of a century after the pillage of Rome by the Vandals.

about the middle of the sixteenth the reaction was complete. Paul III., Farnese, even passed a law by which the severest penalties were inflicted on those who threw torsos or fragments of sculptured marble into lime-kilns.

The following are the principal arguments by which Fea\* supports his conclusion that few works of art are likely to be found in the Tiber in the present day:

(1) In laying new foundations for the Ponte Sisto† in 1474, and for the Pons Æmilius (Ponte Rotto) in 1554 and 1575, nothing of any value was found.

(2) In the seventeenth century the bed of the Tiber was examined in every part by antiquarians and engineers, among whom may be mentioned the names of Bacci, Lombardi, Castiglione, Bonini, and Fontana, with the object of removing impediments to the flow of the stream, and suggesting a sure and permanent remedy against the frequent inundations.

(3) In the year 1744 the banks and middle of the river were visited and carefully sounded, in all their extension and depth, from Ponte Molle to the Marmorata, by the engineers Gambarini and Chiesa, acting under the directions of Pope Benedict XIV. On neither of these occasions is there any mention of statues.

Nor at any other time is there a well-attested instance of the discovery of a valuable work of art in the Tiber, though stories have been current of divers meeting with statues, which they were afraid to remove without receiving permission from the Pope.‡ Yet, led by these stories, Montfaucon observes in his "*Diarium Italicum*:" "*In Tiberi non statuas modo et marmora pæne infinita latere experimento plurimorum conspicuum est, sed etiam thesauros, eodem conjectos olim, extare;*

\* Fea, *Novelle del Tevere*.

† It may be observed that if sculptures or other objects had been wilfully cast into the river, they would, probably, have been thrown either from the bridges or the banks, and have been found in close proximity to one or the other.

‡ Fea, *Novelle del Tevere*.

et numismata omnis generis educi indies narrant bene multi Romanorum."\*—Cap. xvi.

The tradition of the golden candlestick flung into the Tiber to save it from the enemy may rank with the story of the entertainment† given by Agostino Chigi to Pope Leo X. The service of plate off which the Pope had condescended to dine was, so goes the story, cast into the Tiber in order that it might never be applied to baser uses. But a net, it is said, was spread to receive it, and the plate was recovered at a convenient opportunity. In like manner, if the golden candlestick, the property of the Emperor, or, rather, of the State, had been flung into the river, it must have been done officially, and several persons must have been privy to the act. When, therefore, the danger was past, an object so precious would have been removed, either openly or by stealth.

\* *Diarium Italicum* à R. P. D. Bernardo di Montfaucon, monacho Benedictino. Montfaucon, who visited Rome at the close of the seventeenth century, transcribes from Flaminio Vacca, a Roman sculptor and antiquary, his account of a consul in a sitting position, and holding a roll of paper in his hand, but without a head, which had been found by a diver between the Porta Flaminia (Porte del Popolo) and the Ripetta. It was the work, according to Vacca, of a very skilful artist, and in his time was on view in the house of one Palombo, a notary, whose house was behind S. Maria in Via. As far as I can learn, this work is no longer in existence.

† An account of this entertainment is given by Zanucci (*Opere pie di Roma*, lib. II. cap. 21). Agostino Chigi, according to Zanucci, was the richest merchant that had ever lived or, probably, ever would live. Neither he nor his agents knew the amount of his wealth. It was on the occasion of his marriage that Chigi feasted the Pope and twelve Cardinals in a temporary building erected in the course of a single night, close to the Farnesina palace and on the banks of the Tiber, by an inundation of which it was afterwards swept away. Every delicacy which money could procure was set before the guests, and, as each course was removed, the plate on which it was served was thrown into the Tiber. Zanucci is simple enough to observe that "it was never seen again," "più non comparivano," evidently believing that the Tiber, no more than the deep, could be made to give up its treasures. There is no contemporary authority for the story, for Zanucci, Hadrian, Junius, and others, quoted by Bayle in his "Dictionary," and by Platner in his "Beschreibung der Stadt Rom," lived in the latter half of the sixteenth century, and "have not," as Bayle complains, "the goodness to tell us in what author they read the account."

Other stories are current respecting it, all marked by extreme improbability or absurdity. It is said that the temple of Peace, in which, according to Josephus, the sacred utensils of the temple of Solomon were deposited, was consumed by fire, and that the candlestick perished in the conflagration. So intense, we are told, was the heat that the metals used in the interior decorations were fused and ran in streams along the streets.

There is much improbability in this tale. In the time of the Empire the body of a Roman temple was built exclusively of brick or stone. No woodwork was used for internal decoration or convenience, like the pews of modern churches. It was only in the roof that rafters of timber were employed. Now, if the fire had originated in the roof, it is scarcely possible that the heat could have been as great as is described, or that the candlestick and other treasures of the temple of Solomon could have been melted into an unrecognisable mass. On the other hand, if the fire had broken out in the neighbourhood, it is very unlikely that no efforts would have been made to rescue such interesting historical monuments before the building, in which they had been deposited, was surrounded with an ocean of flame, such as is said to have caused their destruction.\*

The story of the candlestick falling into the Tiber during the flight of Maxentius is the most absurd of any, for what motive had he for taking it with him when he went forth to encounter the army of Constantine in the immediate vicinity

\* In the "Times" of July 15, 1872, there is an account of the partial destruction by fire of the church of St. Mary Magdalen, Paddington. The fire originated in the roof of the chancel, where it continued to burn until the roof was entirely destroyed; but, though the blazing rafters fell within the church, the interior sustained but little damage. Even the painted windows were only partially cracked, and the organ was but slightly injured. The escape of the church from total destruction was due partly to the absence of pews and partly to the ascending current of air, which carried upwards a great deal of the heat generated in the roof.

It is plain from this that the burning of the roof could never produce heat enough to melt gold and silver in the interior. Even the hangings, if any, or the votive offerings, the only combustible matter we can conceive to have existed in the body of the temple would, from their light nature, have been too quickly consumed to have generated the heat required to produce the effect supposed.

of Rome. If he had been victorious, the candlestick and all other treasures would have been safer at Rome than anywhere else; and, if vanquished, he knew that they must fall into the power of the victor. As well might a king go forth to some future battle of Dorking, taking with him the regalia from the tower.

Some time ago there appeared a letter in the "Times," informing us that we were all in the dark about this interesting monument of antiquity, and that, instead of reposing in the mud of the Tiber, waiting to be brought to light by some enterprising individual or company, it was lying fathoms deep at the bottom of the Mediterranean. The writer of the letter had dipped, it seems, into Procopius, and lighting upon a page, in which mention is made of a tradition, that a ship had foundered laden with statues and other spoils carried off by Genseric from the temple of Jupiter Capitolinus, he assumed without warrant that the sacred objects in question formed part of the cargo, and imagined that he had thus accounted for their fate. If he had taken the trouble to read a little further, he would have found that the *κειμήλια*, as Procopius calls them, of Solomon's temple, after the conquest of the Vandal kingdom, were removed by Belisarius from Carthage to Constantinople, where they figured in his triumph, as they had done in that of Titus, after which it was proposed to preserve them in the capital of the Eastern Empire.

But a Jew, says Procopius, having learnt what was intended, procured an audience of one of the intimate friends of the Emperor Justinian, and addressed him in the followed words: "It would be unlucky, I am convinced, to introduce these treasures into the palace of Byzantium, for it is not possible that they should remain with propriety anywhere but in the city where Solomon, the king of the Jews, originally deposited them. It was for this reason that Genseric was enabled to capture the palace of the Romans, and that now the army of the Romans has captured the palace of the Vandals."\*

\* *ἐν τοῖς καὶ τὰ Ἰουδαίων κειμήλια ἦν ἅπερ Ὀυεσπασιανοῦ Τίτος μετὰ*

When these words, observes the historian, were reported to the Emperor, he was seized with dread, and sent away everything in haste to the churches of the Christians at Jerusalem.

It will be observed that Procopius does not specify the articles of which the *κειμήλια* consisted, so that it is not absolutely certain that the candlestick was among them, but its loss or destruction would, probably, have been noticed.

After its removal to Jerusalem all trace of it is lost, yet neither intrinsic improbability nor historic evidence can shake the faith of many in the popular tradition, and the same story is still repeated by modern travellers. "Here, or hereabouts," observes Hawthorne, as he crossed the Ponte Molle, "lies the golden candlestick at the bottom of the Tiber."

The story, incredible as it is, was improved upon by the Talmudists, who were unwilling to be outdone in absurdity. In order that their sacred candlestick might lie in greater state, and that the world might form a more exalted notion of their riches and their wrongs, they fabled that the Tiber from Rome to Ostia had been paved with bronze, and that the work had been accomplished with the tribute collected from their nation by Augustus and succeeding Emperors.\* It would scarcely be more irrational to believe that there may be some foundation for this story than to think that the candlestick may possibly be found in the mud of the river.

"Fea thus concludes: "When we consider how many statues have been found under the ruins of the buildings in which

*τὴν τῶν Ἱεροσολύμων ἄλυσιν ἐς Ρώμην σὺν ἑτέροις τισὶν ἤνεγκεν, καὶ αὐτὰ τῶν τῶν Ἰουδαίων ἰδῶν καὶ παραστὰς τῶν βασιλέως γνωρίμων τινὶ ταῦτα, εἶφη, τὰ χρήματα ἐς τὸ ἐν βυζαντίῳ παλάτιον ἐσκομίζεσθαι ἀσύμφορον οἶμαι εἶναι· οὐ γὰρ οἴοντι αὐτὰ ἑτέρωθι εἶναι ἢ ἐν τῇ χώρῃ οὗ δὴ Σολομὼν αὐτὰ πρότερον ὁ τῶν Ἰουδαίων βασιλεὺς ἔθετο. Διὰ ταῦτα γὰρ καὶ Γεζήρικος τὰ Ρωμαίων βασιλεία εἶλε, καὶ νῦν τὰ Βανδύλων ὁ Ρωμαίων στρατὸς. Ταῦτα ἐπὶ ἀνερχόμενα βασιλεὺς ἤκουσε· ἰδεῖστέ καὶ σύμπαντα κατὰ τάχος ἐς τῶν Χριστιανῶν τὰ ἐν Ἱεροσολύμοις ἱερὰ ἐπέμψε.—Procop. de bello Vand. II. cap. IX. sec. 2.*

\* This I give on the authority of Bonini and Fea, not being myself acquainted with the writings of the Talmudists. According to Bonini, the Talmudists wrote that, while the Emperors furnished the funds, the work itself, being beyond the power of mortals, was executed by demons.



they were originally deposited, shewing that they had never been removed; how many were burnt for lime during the dark ages of Europe; and how many, notwithstanding, have been disinterred, sufficient to people all the museums of Rome, Italy, and Europe, there seems no reason to imagine that the number remaining undiscovered is so great as is supposed, or that more would be found in the bed of the Tiber than in any other area of equal extent.

## ROMAN TERMS FOR COLOUR.

Exception has been taken to the translation of "flavus," which signifies, it is contended, not "auburn," but a brownish yellow, the colour of ripened corn. But it is as impossible to say what particular shade of colour is intended by a given Latin word as to form a clear conception of the musical terms of the Greek; for neither colour nor sound admits of description in words. Our difficulty is increased by the looseness with which such terms as "fulvus," "cœruleus," and "purpureus," are employed by the poets. Thus we have in Virgil "fulvum aurum" (*Æ.* vii. 279), "fulvum leonem" (*Æ.* iv. 159), "fulva aquila" (*Æ.* xii. 751-2), and "lumine fulvo" (*Æ.* vii. 26). Between the colour of gold, or flame, and that of an eagle, there is certainly a wide difference.

"Cœruleus" may mean any hue from sky-blue to dark green, a light, or sea-green being probably that of the river gods. A sky-blue Acis would have been a repulsive object to Galatea; a sea, or olive-green, would have been more endurable; but it does not appear that the lovers ever met after the change of Acis into a god.

Purpureus is still more vague, and may mean any dark or any bright and dazzling colour, except, perhaps, yellow and green; for we have in Virgil, "mare purpureum" "the dark sea," (*G.* iv. 373), in imitation of the "ἄλα πορφύρεην" of Homer, and in Horace "purpureis ales oloribus" (*Car.* iv. i. 10). To talk of purple swans may seem to be carrying poetic licence pretty far; for it is scarcely necessary to observe, that the black swan, found only in Australia, was not merely a "rara avis in terris," but absolutely unknown to the Romans. The truth is, the word "purpureus" came at last to signify nothing but sparkling beauty on the one hand or any dark colour on the other.



But of the words which I have mentioned none is more uncertain in its acceptation than "flavus." Riddle and Arnold, in their comprehensive English and Latin Dictionary, translate "auburn" in one place by "flavus," and "yellow" in another by the same word. When the Romans attempt to explain the force of their own terms, they only add to our perplexity. In a discussion upon colours in Aulus Gellius (*Noctes Atticæ*. II. 27), "flavus" is enumerated among the "*rufi colores*," or "reddish colours," and defined to be a mixture of "white," "green," and "red": "*ex viridi, et rufo, et albo concretus*."

The only thing certain about "flavus" is, that hair of that colour was considered beautiful by the Romans, like "auburn" in the present day, and that the term was applied by an euphemism to the Tiber, in which yellow predominates, just as the name of "auburn" might be claimed by a lady, or her admirers, for hair which to others would appear an unmistakeable red.

#### ON THE PROPOSED SCHEMES FOR PREVENTING THE INUNDATIONS OF THE TIBER.

No subject in Nature possesses a greater interest for man than that of rivers, whether we consider their ornamental character, their commercial utility, or their importance to the cultivation of the soil. Next to the forces by which the strata have been upheaved and the mountain ridges formed, rivers have been the most potent agents in determining the configuration of the surface of the globe. By the rush of their waters they have scooped out deep ravines, while by their inundations in their lower course, they have created the wide alluvial plains and clothed the rocky skeleton of a primeval world with a rich deposit of vegetable mould. The prosperity, and even the existence of a people, may depend upon them, for they are the highways of commerce, and, when the rainfall is uncertain or deficient, they supply the means of correcting by irrigation the capriciousness or the parsimony of Nature. Everyone knows that Egypt is dependent on the Nile; and, to use an illustration on a smaller scale, the historic city of Damascus would perish by drought, and the green oasis in which it is situated would revert to the condition of a sandy waste, if the little river Abana were diverted from its course. Charmed by their beauty, grateful for the benefits which they confer upon mankind, and awed, perhaps, by the power which they exhibit in their angry moods, the ancients attributed to rivers a supernatural character, and paid them a religious worship. Every river had its god, while the smaller springs and fountains, which never failed in summer or overflowed their banks in winter, were supposed to be presided over by divinities of the softer sex. As a consequence of this feeling, the benefits of rivers were accepted with gratitude, and the havoc which they sometimes commit, was submitted to with

resignation, as a necessity of Nature or a manifestation of the anger of the river god. To divert them from their course or to lessen the volume of their water was thought to be offensive to the deity of the stream, and when, in the reign of Tiberius, it was proposed to turn into new channels the tributaries of the Tiber, in order to lessen the inundations of that river, the crowning objection brought forward against the scheme was, that "Father Tiber would be unwilling to be bereft of his affluent streams, and to flow henceforward with diminished pride."

Not a trace of this sentiment remains in the present day, when everything is regarded only in relation to material considerations. On the contrary, we heap every kind of indignity on our streams. We make them the receptacles for the excreta of man and for the refuse of manufactories, and, in order to secure some imaginary advantage or to avert some local or temporary inconvenience, we mar their beauty by diverting them into new and unpicturesque channels or confining them between artificial mounds.

Were the results anticipated from these operations attained, the lover of Nature, and the man of poetical temperament, and literary or scientific tastes, would acquiesce in the change, because the pleasure derived from the beauty of rivers, and from their historical or legendary associations, must give way to material advantages; but, except in the case of a few mountain torrents and estuaries, I am not aware that any real advantage has been gained by diverting the course of rivers,\* and it is certain, that rivers when embanked, become sources of present anxiety and of future danger, greater than any which it is our object to prevent.

\* This observation does not apply to works like the Bedford Level. This is a straight cut from a point on the lower course of the river Ouse to the sea. The Ouse had been embanked for the purpose of reclaiming land from the sea, and by substituting a straight for a tortuous course, not only was a slight fall gained, but, what was of more importance, the embankment was less liable to be undermined, and, consequently, the expense of keeping it in repair was reduced. But this is no precedent for diverting a river where little fall is to be gained and where no embankments are required.

The engineers who suggest these alterations for the purpose of preventing inundations may be well acquainted with the mechanical part of their profession, the driving of tunnels and the construction of skew bridges and of viaducts, but they are often as ignorant of the principles of physical geography as they are devoid of taste; otherwise, they would know that inundations are by no means an unqualified evil, and that they are one\* of the means by which the earth has been fertilized, and by which its fertility will be maintained if man does not interfere to thwart the purposes of Nature. "The true golden sands," says Torricelli, "are the sediment of rivers," and the increased fertility of a small plain overflowed by the Loire in 1846 was said by the government engineers to have more than compensated for the destruction of a few houses, which were sapped and overthrown by the flood. The floods, also, to which all rivers in a state of Nature are liable, are the means by which the relative level of the river and the adjoining country is maintained. If, therefore, we succeed in preventing the inundations of rivers, by widening and deepening their channels or diverting their course, we deprive ourselves of certain compensating advantages; while, if we attain the same end by means of embankments, we not only interfere with the adjustments of Nature, but create new dangers, which increase year by year, until they culminate in some great disaster. That we shall rarely succeed in our attempts to prevent inundations, and that success would be productive of evils greater than any which we desire to avert, I will try to shew.

When a river flows through a mountainous country or elevated plateau, where the descent is measured by tens of feet in a mile, a deeper and straighter channel may be dug and a considerable fall be gained. In this way, in Switzerland, the damage done by inundations has in many cases been prevented or moderated. Again, when a river is embanked

\* The other is the disintegration of certain rocks, especially those of igneous formation. The fertility of volcanic soils is proverbial.

for the purpose of enabling marshes to be cultivated or land to be reclaimed from the sea, a straighter and shorter artificial bed will not only lessen the cost of embankment in the first instance, but also the expense of keeping it in repair. When, also, the bed of a river is narrowed or its channel crossed by a ledge of rocks, the rocks may be blown up and the level of the water be permanently lowered, because no operation of Nature can restore the rocks. In this instance, the bed of the river is determined by the configuration of the surface and the stratification of the rocks,\* and man does but aid and accelerate the natural process by which the rocks are slowly worn away. There is no fear, therefore, lest Nature should undo his work. But the case is widely different when a river flows with an inconsiderable descent through an alluvial plain or occupies, like the Tiber, a portion of a wide alluvial valley. Here the bed of the river, like the alluvial plain or valley, is the creation of the river itself. A river, by a sort of instinct, chooses the most convenient course, and when it is free to scoop out its channel in an alluvial soil, the breadth and depth of the river at any point will be suited to its requirements at that point. If, therefore, an artificial addition be made to that breadth and depth, the only result will be that the sides and bottom will be filled with nearly stagnant water, a rapid deposit of mud will take place, and in a short time the work of man will be undone. We may see an illustration of this in the Tiber and other rivers when a portion of the bank falls in. The little bay so created is soon silted up; and, if the land be valuable, the process may be accelerated by partially enclosing it with stakes.

Many engineers reason as if they thought that Nature had

\* The Rio Negro, a large tributary of the Amazon, is represented in some maps as flowing at a certain point of its course in a channel no less than nine miles in width; but it is not said whether the river at the point expands into a lake or threads a multitude of islands with numerous and shallow streams. As the substratum here is granite, the latter is probably the case, the river being prevented by the granite from deepening its bed. Lower down, though the soil is alluvial, it is fifteen miles across.

made a calculation of the largest quantity of water which a river would have to convey, and had adjusted the dimensions of the channel to that quantity, so that, if a river ever overflows its banks, it must be owing to some stricture, as it were, in its bed, which it is the province of engineering science to remove. But the breadth and depth of a river are determined, not by the volume of water in time of floods, but by the average of the quantity which it discharges in the course of a year. Accordingly, in Australia, where long droughts alternate with deluges of rain, the bed of rivers is often ridiculously small compared with the sea of waters which they bring down after heavy rains. The Murray at Echuca (Victoria Colony), after a course of between three and four hundred miles, is no wider in summer than the Tiber at the Ripetta; yet, during great floods, it is sometimes a mile across and forty-five feet deep. What would be the dimensions of an artificial bed sufficient to carry off this body of water without overflowing, and what would be the expense of keeping it free from obstructions during the season of drought, so that it should perform its office when the rains returned? Let the engineers who propose to operate upon the Tiber reply.

Those who expect great results from widening, deepening, straightening the Tiber, and removing a few petty obstructions in its bed, must be ignorant of the history of the river under the Roman Emperors. We learn from Dion Cassius that, in consequence of the great inundations in the reign of Tiberius, conservators "of the bed and banks of the Tiber" were appointed, whose office was to keep the river within bounds. These conservators were men of the highest position; they were armed with every power required for carrying out their object, and they were backed with all the resources of the State. Yet, though they employed the same means which are now suggested, as if those means had never been tried before, history informs us that they accomplished nothing. In the reign of Otho we learn from Tacitus that the Tiber rose so suddenly that people were swept away in the public streets, while, according to Suetonius, for twenty miles above Rome

the road was obstructed and the march of the army of the Emperor impeded by the ruins of buildings which had been overthrown by the flood. To pass over the many inundations in the subsequent reigns, among others that in the time of Trajan, recorded by the younger Pliny, we come to the great flood described by Ammianus Marcellinus, who lived in the reign of Valentinian and Valens, when the whole of Rome was converted into a sea, and only a few elevated spots appeared like islands above the watery waste. During four hundred years, therefore, nothing had been achieved, and the conservators had been playing a losing game with Father Tiber. Why, then, should we expect that more would be effected by the same means in the present day? Does anyone suppose that the Tiber is broader or deeper now than it was in the time of the Romans? If not, Nature must have undone all that the Romans accomplished in the way of widening and deepening the river; and will undo, in like manner, all the digging and dredging of modern engineers.

But much, it is said, may be expected from the removal of the piers of the Sublician, and Triumphal bridges, and of other obstructions, such as the ruins of the Emilian bridge, called the Ponte Rotto. The engineers from whom the report on the Tiber emanates appear to have added together the little falls of inches and half feet produced at low water by the obstructions in question, and assuming that the same difference of level will remain when the river is flooded, they assure us that the inundations may be lowered two metres, or more than six feet, by the operations they contemplate. But, if they had ever studied the phenomena of floods, they would have remarked, that the effect of a rise in the water is to obliterate differences of level,\* and to cause the surface to make a

\* The reason of the obliteration of the differences of level is that, when the river is rising, the water above the fall arrives faster than it can flow away. Conversely, when the river is falling, the water flows away faster than it can arrive, and the fall reappears. If immediately below the first fall there is another similar fall, the effect would take place below the second fall, which would be obliterated first, and then, if the river continued to rise, the first fall would

smaller angle with the horizon. Any one who takes the trouble to observe, may satisfy himself of this. If there is a weir across a river, it will be seen that, as the river rises, the fall diminishes, until the fall becomes a rapid. As the rise continues, the violence of the rapid lessens, until nothing but a ripple marks the place where the fall once was. As the river sinks, the rapid reappears, and then the fall. The same effect is produced at every trifling descent, until the whole surface becomes more uniform, and makes a smaller angle with the horizon. It is evident, therefore, that those objects which are buried deep beneath the flood, like the piers of the ancient bridges, can have no appreciable effect upon its height.\*

As to the Ponte Rotto, it is absurd to suppose that the remaining arches of that bridge can offer any sensible impediment to the passage of the floods. The suspension-bridge affords abundant water way, and the fact of the bridge having been carried away on that side shows that the current is directed towards the south-eastern shore. Even the Ponte Sisto has very little effect upon the height of floods. During the inundation of 1870, the Ponte St. Angelo was unapproachable; but I succeeded in reaching the Ponte Sisto when the flood was at its height. Here the rush of water was very great, but

gradually disappear, and so with any number of small falls succeeding each other, like the steps of a stair. It is astonishing that the Italian engineers should have taken no account of this phenomenon, which any one may observe during the rise of a river, and which is treated of in Vallès' "*Etudes des Inondations*," a work which every one who deals with rivers ought to read.

It is part of the scheme finally decided upon by the Commissioners appointed to regulate the course of the Tiber, to cut through the neck of the bend of the river at San Paolo. The fall gained in this way would not, I believe, amount to two inches, and would have no sensible effect upon the floods. It would be impossible by this means to confine the river within its bed, and when the whole valley at San Paolo became a lake, the difference between the two channels would wholly disappear.

\* On this subject see Vallès' "*Etudes sur les Inondations*," page 339, 340. Paris 1857. Strictly speaking, the difference of level will never be entirely obliterated; but the height of the water, above and below the obstruction, will, as the river rises, approach nearer and nearer to a ratio of equality, just as a curve, when indefinitely prolonged, approaches closer and closer to its asymptote, but never actually coincides with it.



there was no fall, such as the damming up of the river by the piers of the bridge would have produced. On the contrary, the water, after passing through the arches, boiled up in such a manner as almost to deceive the eye into the belief that the level of the water was higher below than above the bridge. If, now, the Ponte Sisto, which extends across the stream, has so little influence on the height of floods, how slight must be the effect of the remaining arches of the Ponte Rotto, which occupy only one side of the river, and that the side where the current is feeblest. How preposterous, then, would it be to incur the expense of removing these arches, and constructing a new suspension bridge, in order to lower the floods an inch or two, or perhaps only the fraction of an inch.

The Ponte St. Angelo offers, no doubt, a considerable obstruction to the passage of the water, when the river attains a certain height; for the flood in 1870 rose above the crown of the arches. But such an act of Vandalism as the destruction of this bridge is not contemplated, I believe; nor is the Ponte St. Angelo the only cause of floods; for it was not in existence during the great inundations recorded by Dio Cassius, Tacitus, and Pliny, in the times of Cicero, Tiberius, and Trajan. Something, indeed, may be gained by clearing away the sand with which the side arches are encumbered, and the level of the floods may be slightly reduced by widening the river at the gardens of the Farnesina; for the Tiber at that point has been artificially narrowed, and the obstructions placed by man may be removed by man; nor will the river have any tendency to restore what the river has not created. But these two operations combined will not, I am convinced, lower the floods one foot, while the effect of removing the piers of the Ponte Rotto will, for the reason I have given, be inappreciable.

The truth is, that the inconsiderable fall of the Tiber, between Rome and the sea, amounting only to eight inches in a mile, leaves no margin for lowering its bed. On the other hand, if we widen it at a point where no *artificial* obstruction exists, our labour will be thrown away; for if the width had

been insufficient, the river, by its abrasion, would have done the work itself. Were it possible to bring up the level of the sea to Rome and to widen the Tiber a thousand feet, in a short time the great ditch so created would be filled by a rapid deposit of mud on the horizontal bottom, the space dug out at the sides, not being utilized by the river, would be silted up, and the old dimensions of the channel would be restored. This is the reason why the ancients failed in their endeavours to prevent inundations by widening and deepening the river's bed, and why we, if we employ the same means, shall be sure to fail. I have before shown that the removal of the so-called obstructions can have no effect. The idea, therefore, of lowering the floods in any sensible degree by operations on the bed of the Tiber may be dismissed as chimerical.

But there is another scheme often projected, though never carried out by the ancient Romans and the Romans of the sixteenth and subsequent centuries, that of diverting the Tiber wholly, or partially, from the city. As the former scheme, that for diverting the river into a new channel and filling up the old bed has been abandoned, on account of its enormous expense, little notice need be taken of it, except to observe that the very conception of such a plan shows the stupidity and tastelessness of the modern Romans. A river is always useful, and may be made ornamental. Most important cities, when their site has not been determined by considerations of safety or the proximity of minerals, are situated upon rivers. Livy puts into the mouth of Camillus a speech, in which he enlarges upon the advantage which Rome enjoyed over Veii in being built upon a navigable river, and even in the present day the Tiber is utilised to a certain extent, though far less than in the time of the ancient Romans. In their time, also, it had an ornamental character, and villas of the rich and noble were erected along its banks. These are alluded to by many writers. I will instance only the line of Horace:

*Cedes coemptis saltibus, et domo,  
Villaque, flavus quam Tiberis lavit.*—Car. II. 3.



and the passage of Pliny in which he observes that "all the rivers in the world together were not peopled and adorned with so many villas as the single river Tiber."—III. (9) 54.

What, then, could be more preposterous than diverting at an enormous expense a river which is already useful and might be made highly ornamental, and which was styled by a poet of the Empire, who wrote in Greek hexameters, "the most regal of rivers,"\* in reference, probably, to its magnificent surroundings, the stately buildings, and lordly villas, with which its banks were lined.

But, as this scheme has been abandoned, not on account of its absurdity, but its enormous expense, I will confine myself to examining the other, that, namely, of digging a canal, which, commencing above the junction of the Anio and the Tiber, shall carry off the entire water of the former and a portion of the latter, whenever it reaches a certain height. The canal is intended to join the Tiber again in the neighbourhood of San Paolo fuori le Mura. This plan would entail a less expense than the other, but as it would, in my opinion, fail to attain its end, the waste of money would be greater still. In the first place, the total diversion of the Anio will have little effect in lowering the inundations of the larger stream. Anyone who takes the trouble to inspect the map will see that the Anio drains but a small portion of the basin of the Tiber, and that its length is less than that of the Nera, or of the Tiber above its junction with the former stream, some miles higher up than Orte. Since, then, Orte is sixty miles above Rome, the combined floods of the Tiber and the Nera would, if we suppose the current to flow at the rate of five miles an hour (which is, probably, above the average), reach Rome twelve hours after that of the Anio; but by that time the flood of the Anio will have come and gone, to say nothing of its being, in a great measure, lost in the much wider bed of the Tiber. On the other hand, the upper Tiber and the

\* Θύμβρις ἐνδρείτης ποταμῶν βασιλεύτατος ἄλλων. Dionysii Alexandrini, τῆς οἰκουμένης περιήγησις.

Nera, which are nearly of the same length, and the Chiana, which, though shorter, flows with a more sluggish course, will, when swollen by a rain extending over the whole of their basins, come down simultaneously with a head of water. The effect, therefore, upon the floods of abstracting the entire water of the Anio may be left out of consideration.

Let us now examine the other part of the scheme for diverting a portion of the water of the Tiber in time of floods and restoring it, along with that of the Anio, to the river at a lower point. When we consider the slight fall of the Tiber from the Anio to San Paolo, the conception of the Italian engineers is scarcely reasonable. Again, in all the reports of the engineers two tacit assumptions appear to be made; first, that as soon as the Tiber reaches a certain height it will rush into the canal as if a sluice were opened; and, secondly, that the inundation in the main stream will be lowered in proportion to the quantity of water abstracted; so that, if we could draw off by means of the canal one-third of the additional volume of water in time of floods, we should reduce the height of the floods by one-third.\* Both of these assumptions are false, as everyone knows who has studied the phenomena of rivers. Supposing the Tiber at Rome flowed through an elevated plateau, and there were a great rapid or cataract in the neighbourhood of San Paolo, then, if the canal joined the river below the rapid, a considerable inclination might be given to its bed, the water from the Tiber would flow into it as from a dammed-up mill-pond, and the height of the river above the point of diversion might be lowered several feet. But as no such rapid exists, the slope of the bed of the canal cannot be made greater than the slope of the Tiber between the Anio and Rome, and the slope being the same, and that slope only eight inches in a mile, there is no reason why the water should elect to enter the canal instead of pursuing a more direct course down the channel

\* The second assumption would be correct, if the quantity abstracted could be annihilated instead of being merely diverted.

of the river. In fact, as the current of a river is always most feeble at the side, and the Anio, which will form part of the canal, enters the Tiber at right angles, it will be found extremely difficult to coax more than an insignificant portion of the flood to enter the canal.

Again, it is not true that the height of the flood will be lowered in proportion to the quantity of water abstracted by the canal. If a tributary joins a river, it is found that the height of the river is not increased in the ratio of the volume of water discharged into it by the tributary, but its velocity is augmented. Conversely, therefore, when a canal is diverted from a river, the velocity of the current in the river will be lessened, but the surface will be lowered in a far less ratio than the quantity of water abstracted. When, therefore, we consider how small a portion of the flood water is likely to enter the canal, and how little that portion would lower the height of the floods, we may well pause before we incur the expense of digging the canal, of bridging it, and of keeping it free from sandbanks and other obstructions.

In what I have written I have introduced no arithmetical calculations or algebraical formulæ, but have satisfied myself with indicating general principles, partly because the numerical details of the scheme are not yet settled, and partly because mathematical calculations as to the flow of rivers are altogether illusory. When the subject first attracted the attention of scientific men it was investigated by Torricelli in his closet, not, as it ought to have been, on the river banks, and his algebraical formulæ conducted him to the conclusion that the velocity of a river is greatest at the bottom, which everyone knows to be the reverse of truth. In fact, the flow of rivers is in a great measure an empirical science, or a science of observation and experiment. Owing to the irregularities in the breadth and depth of rivers, the subject is so complicated that mathematics will avail us little, or lead us farther astray, because the postulates or data can never be ascertained with certainty. Torricelli, as we have seen, deduced by calculations which were undoubtedly correct, from premises which were

certainly false, an utterly erroneous result, and calculations of the volume of water discharged by rivers often differ so widely in amount as to shew either that the formulæ used are incorrect or that the conditions under which they are applied are continually varying. It is with rivers as with the tides and with the weather. We know the cause of the tides and the height to which they rise in the open sea; yet what mathematics would have enabled us to foretell that, while the tide is only eighteen feet at the mouth of the Bristol Channel, it rises thirty at Swansea and fifty at Chepstow, and that, while it attains an elevation of one hundred and twenty, according to some, in the Bay of Fundy between Nova Scotia and New Brunswick, it rises only seven feet at Green Bay, separated from the Bay of Fundy by nothing but a narrow isthmus? Similar observations may be made with regard to the weather, the causes of whose changes are well known to us, though it is only empirically and within narrow limits of time that we can forecast those changes.

As I have treated elsewhere the subject of embankments, and as it is not proposed to erect huge dikes along the banks of the Tiber for the purpose of keeping out the floods at their greatest height, I will confine myself to observing that the Tiber, considering its low level in summer, may be looked upon as a river naturally embanked, and occasionally overtopping its natural embankments. All, therefore, that reason and good taste would suggest would be to raise those banks where they are below the general level, and to form quays of stone at that level. These would be a convenience to navigation, an ornament to the town, and a handsome promenade. Everything beyond would be an eyesore, and a greater nuisance than the floods themselves.

I will now recapitulate what I have said on the subject of widening and deepening the Tiber, and removing obstructions in its bed. Under the Roman Emperors, as I have observed, "conservators of the bed and banks of the Tiber" were appointed, whose office was to keep the river within bounds. These conservators employed the same means which are sug-

gested in the present day, and with what result? In each successive reign we read of inundations as great as any which preceded them, and culminating in the great flood recorded by Ammianus Marcellinus. Not only did the alterations in the bed of the river produce no effect, but the alterations themselves have disappeared, and the river has resumed its normal width and depth.

With regard to the piers of the ancient bridges, I have shewn that they can produce only an infinitesimal effect when the river has attained a certain height. If three or four blocks of stone were lying at the bottom of a river twenty-five to thirty feet deep, no one would expect the river to sink when the blocks were removed. Now, the piers in question are, when the water is high, like so many blocks resting on the bed of the stream. Or we may reason in this manner. A body is no obstruction if it does not raise the level of the water above it. When, therefore, the difference of level is obliterated before the river overflows its banks (as it always is, if the object is low and the banks are high), it can produce no effect when the river is brimful, and nothing would be gained by removing it.

As to the canal of diversion, though to most persons it would appear that the amount of water which it abstracts must be regulated by the dimensions of the canal, this is far from being the case. The quantity which enters it depends in a great measure upon the angle which it makes with the river. Why this is so, a little consideration will make clear. The velocity of a river is always greatest in the middle, and if the canal makes a large angle with the river below the fork, the great bulk of the water will pass the mouth of the canal before it can be drawn within its vortex. This is, of course, on the supposition that the slope of the canal at the point of diversion is no greater than the slope of the river at the same point. I will say nothing further about the canal, or discuss the question of barrages for the purpose of forcing the water of the river into the canal, because I have just learnt that this part of the scheme has been abandoned, and that the

commissioners have resolved to confine themselves to operations upon the bed of the Tiber within the limits of the town and its suburbs. In this they have acted wisely, for comparatively little money will be wasted; but they can do nothing, I believe, which will materially lower the height of the floods. I have shewn from history that the widening and deepening the Tiber had no effect in preventing great inundations, and I have, I hope, made it clear that the removal of the piers of the ancient bridges, as well as of the remaining arches of the Ponte Rotto, cannot sensibly lower these inundations. There remain, therefore, only the clearing out of the side arches of the Ponte St. Angelo, and the widening of the river at the Corsini gardens, the combined effect of which will not, I am convinced, amount to a foot.

In conclusion, the advice I would tender is to leave the river alone, or confine ourselves to improving it by building quays of stone, for ornament or convenience, at the general level of the banks, not by raising dikes with the intention of preventing inundations altogether. If the piers of the Triumphal and Sublician bridges are to be removed, it must be with the purpose of improving the navigation, not with the hope of lowering the floods. Father Tiber in every age has shewn himself a sturdy antagonist and hard to deal with. He resisted all the efforts of the Romans in their palmiest days to control him, and it is not likely that he would be overcome by weapons similar to those which they employed, but wielded by feebler arms. Instead, then, of trying to prevent floods by an expenditure, the interest of which in an average of years would exceed all the damage done by the floods in the same space of time, let us use the appliances of modern science, the rain gauge and the electric telegraph, to enable us to foresee them. I myself anticipated the great inundation of 1870 three days before it occurred, and twenty-four hours beforehand I confidently predicted it to some friends. What I did everyone else might do, by taking account of the height of the river at a given time, by measuring and obtaining information regarding the depth of the rainfall in each of the

Tiber's tributary streams, and by forming some conjecture, from previous meteorological conditions, as to the depth of snow upon the mountains. The cry of "wolf" may sometimes be raised in vain, but the wolf should never be allowed to steal upon us unawares.

## CLIMATE OF ROME IN ANCIENT TIMES.

The formation of ice in a rapid river like the Tiber may seem to imply a more intense degree of cold than any which is experienced in the present day, and the line "*Hibernum fracta glacie descendet in amnem*" (Juv. vi. 521) may be added to those which are usually quoted from the Roman poets and historians to prove the greater severity of the Italian winters in former times. Everybody will recall the stanza of Horace in which he describes Soracte as white with snow, the trees as bending beneath their load, and the streams as arrested in their course by frost; to which we may add two other lines of the same poet:

*Diffugere nives, redeunt jam gramina campis  
Arboribusque comæ.*—Hor. Car. 1v. 9, 1.

The snows have disappeared, herbage now returns  
To the fields, and foliage to the trees.

The "jam" appearing to imply that the snow had remained some time upon the ground.

The passage, also, in the Georgics of Virgil:

*Cum nix alta jacet, glaciem cum flumina trudunt.*—G. i. 310.

When the snow lies deep, when the rivers are bringing down ice,

appears to favour the same idea. But poets are bad authority in matters of science.\* Their office being to excite the

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\* When a poet describes in verse special objects in nature or phenomena which occurred at a given time and place, he may, of course, be received as authority. Thus Ovid's account of the "*Muræna*," in his "*Halieuticon*," is accepted by Naturalists. In like manner, Horace's description of the weather preceding the great inundations of his time, in the ode commencing "*Jam satis teris* . . . . . &c., may be received as evidence of the character of that particular season.



imagination and move the feelings by strong contrasts, they select the most striking rather than the most usual images, they describe the seasons by their grander phenomena or most attractive features, and thus produce a false impression upon those who do not consider the privilege "quidlibet audendi" which a poet enjoys.

In the fourth book of the Georgics, we have an account of an old man from Corycus in Cilicia, who had inherited a small patrimony on the banks of the river Galesus, near the city of Tarentum. This Corycian old man, said the poet, by his industry and skill, succeeded in raising the earliest fruits and flowers of all his compeers, and "even while dreary winter was splitting the rocks with frost, and curbing with ice the current of the streams, he was already gathering the flower of the tender hyacinth, chiding (by so doing) the late summer and the lingering zephyrs."

Et cum tristis hyems etiamnum frigora saxa  
Rumperet et glacie cursus frænaret aquarum,  
Ille comam mollis jam tondebat hyacinthi  
Æstatem increpitans seram zephyrosque morantes.—IV. 135.

Does anyone imagine that Virgil is speaking of a fact within his own experience, or that the winters in the extreme south of Italy were so severe in the time of Augustus that rocks were rent with frost and rapid mountain torrents—for such are all the rivers of that region—were bridled by the ice which collected in their beds? Evidently the poet, in order to heighten the contrast between the rigour of the season and the results of the good man's labours, and enhance the merit of his success, has given us a picture of winter in the abstract, without reference to country or locality.

But, if anyone should still maintain that the language of Virgil is to be literally understood, let him turn to the sixth ode of the second book of Horace, where the poet tells us that, if prevented by hard fate from settling in his old age at Tibur, he will seek the banks of the Galesus, where long springs and mild winters are granted by Jupiter as a boon to man:

Unde si Parcæ prohibent iniquæ  
.....Galesi  
Flumen et regnata petam Laconi  
rura Phalanto  
.....  
Ver ubi longum tepidasque præbet  
Jupiter brumas.....Car. II. 6, 7....18.

How are we to reconcile the two descriptions and explain the apparent contradiction. Evidently by supposing that Horace describes the real character of the climate, and that Virgil does not intend to describe it at all. With Horace, the main consideration was the general softness of the winters of the Galesus; with Virgil, it was the skill and industry of the old Corycian. The winter, in the latter case, is merely mentioned incidentally to mark the early period of the year, and enhance the merit of the old man's success in the cultivation of fruit and flowers, and being so introduced, it is described, for effect, by the most salient features of the season. The words, therefore, "et cum glacialis hyems," &c., mean no more than this; "and even when dreary winter throughout the world was rending," &c.

Similar observations may be made with regard to the other passages which I have quoted.

One who knew nothing of the climate of England, and read the descriptions of spring in the English poets, would imagine that it was the most genial season in the year, whereas it is notoriously the most inclement. Horace Walpole, in one of his letters, observes jokingly to his friend "that the spring had set in with its usual severity," and this character it still maintains. The weather in the latter end of March of the year 1872 was wintry in the extreme, and the boat-race between Oxford and Cambridge was rowed in the midst of showers of snow driven by a north-easterly gale. Throughout the month of April, as everyone knows, cold easterly winds prevail, and even in the "merry month of May" the fair face of heaven is often deformed by driving sleet and the promise of an abundant fruit crop blasted by nipping frosts. The truth is, the spring of the English and the winter of the



Romans are equally ideal; the reality in one case being too harsh, and in the other too tame for the purposes of poetry.\*

It is a necessary consequence of the licence conceded to poets that their evidence, or what is presumed to be such, is conflicting and contradictory, and many passages may be quoted from Horace and Virgil to shew that the general character of the weather in central Italy cannot have altered much during the last nineteen hundred years. The myrtle was not only abundant on the seashore,† but was a favourite shrub in Roman gardens and pleasure grounds, and Horace thus complains:

.....platanusque cœlebs  
Evinctet ulmos; tum violaria, et  
Myrtus, et omnis copia narium,  
Spargent olivetis odorem  
Fertilibus domino priori.—Hor. Car. II. 15, 4.

The bachelor plane tree will displace  
the elms [which were married by the  
vines]. Next the violet beds, and the myrtle,  
and the whole tribe of scents, will scatter  
their perfume over olive grounds which  
were productive to their former lord.

Virgil in his Georgics recommends the cultivation of the myrtle as furnishing stout shafts for spears.‡ It appears, there-

\* In the Book of Job there are allusions to ice and snow: "The streams are blackish by reason of the ice, and wherein the snow is hid."—vi. 16. "Out of whose womb came the ice and the hoary frost of heaven, who has gendered it?" "The waters are hid as with a stone, and the face of the deep is frozen."—xxxviii. 29, 30. Also in the Psalms: "He casteth forth His ice like morsels, who can stand before His cold?"—cxlvii. 16, 17. Job is generally supposed to have been an Arabian Sheik, and Uz, his native country, is conjectured to have lain south-east of Damascus, in an arid region where frost and snow must have been unknown; yet he speaks of rivers as covered with a solid mass of ice, and even of the sea as frozen. If Job, therefore, while illustrating the power of God by the wonders of creation, describes what he could have known only from hearsay, and adorns his poetry with the grander imagery of winter in countries lying far away to the north, why should not the Italian poets have indulged in the same licence?

† Littora myrtetis lætissima .....G. II. 112.

.....amantes litora myrtos.—G. IV. 124.

‡ Viminibus salices fecundæ, frondibus ulmi:

At myrtus validis hastilibus, et bona bello

Cornus.....G. II. 446—8.

fore, that it must have attained a considerable size, and that, consequently, it could not have been liable to be cut down at short intervals by frost. Now, in the middle and eastern parts of England, the myrtle requires protection in winter, and even near Clonmel in Ireland, which is only thirty miles distant from the southern coast, I have seen one which was planted against a sunny wall, and covered with a mat in winter, stripped of all its leaves and partially killed by a severe frost accompanying an easterly wind. It is only in Cornwall,\* the county Kerry in Ireland, and a few sheltered spots on the southern and eastern coasts of the British islands that standard myrtles can be grown.†

It appears, therefore, that, judged by this test, the winters of Rome, in the time of Augustus, could not have been colder than those of Cornwall in the present day, the greater heat of the summer in Italy allowing the myrtle to attain the size which it must have reached to fit it for the purposes indicated by Virgil.

The evidence, therefore, of the poets may be rejected as counteracting itself, or proving nothing but the fertility of their imaginations. Nor is the testimony of ancient historians or naturalists‡ of greater value, unless they speak of some great

A myrtle formed the shaft of the spear of Camilla.

Et pastorem præfixa cuspidis myrtum.—Æ. VII. 817.

The epithet "pastorem" shows that the wood of the myrtle was extensively used by the shepherds for their javelins or for their crooks.

\* Garden hedges are said to be made of the broad-leaved or hardier variety, in the neighbourhood of Cork and Belfast. But there are sheltered spots on the sea-coast both of England and Ireland which have a climate of their own. In the interior of Ireland, the county Tipperary, for instance, myrtles cannot be grown without protection. They may support two or three winters in the open air, but are sure to be cut off at last.

† The myrtles at Rome required no protection; for the "teneros defendo à frigore myrtos," (E. VII. 6) is put by Virgil into the mouth of a Mantuan swain.

‡ Pliny's Natural History, for instance, is nothing but a collection of all the vulgar notions respecting animals and objects in Nature which were current in his time, and of all the foolish stories on the subject which he had been able to collect. He took no pains to sift his materials to separate the true from the

catastrophe of their own times, the details and disastrous effects of which must have been known to many, or of natural phenomena of habitual recurrence to which there is frequent occasion to allude, and concerning which they could not have been misinformed. Among the Romans there was no such thing as science in the modern acceptance of the term. No attempt was made to ascertain by experiment or accurate observation the truth of the facts which they made the basis of their reasoning, or to arrange them systematically, and hence to deduce the laws by which they are connected. The facts were looked upon as independent phenomena, or special interpositions of the Deity, and hence there was no inducement to investigate the truth of a story in order to reconcile it with some acknowledged law of Nature. On the contrary, constituted as human nature is, there was every temptation to exaggerate whatever was wonderful in creation, and to make gratuitous assumptions respecting it. There is a remarkable instance of this in the *Georgics* of Virgil. Virgil here appears, not in the character of a poet, a ποιητής, or composer of fictions, but of a naturalist writing in verse; he comes forward as the instructor of mankind in a useful art, and his work has a practical object. We are entitled, therefore, to require that he should state nothing as a fact, the truth of which was doubtful, and by which his readers might be misled. Yet he assures us that oaks may be grafted upon elms.

.....glandemque sues fregere sub ulmis.—G. II. 72.

And swine have crunched the acorn 'neath the elm.

false, and the doubtful from either; and so careless was he, that he would not give himself the trouble to translate correctly the descriptions of the kingfisher which he borrowed from Aristotle. By a false rendering of a Greek word he represents the kingfisher as having a long neck instead of a long beak, which is ridiculously inaccurate. The only parts of his work which are of any value are those where he describes objects which were constantly before his eyes, or facts which he had witnessed himself, or might have learnt from contemporary sources. The chapters, also, which treat of works of Art supply valuable information not to be obtained from any other source.

Two lines higher up we have a still more extraordinary statement.

Et steriles platani malos gessere valentes.—II. 70.

And barren planes have vigorous apples borne.

This is much the same as if Virgil had assumed as a fact that mules had been bred between a horse and a cow, because he knew them to have been bred between a horse and an ass; for all practical gardeners, as well as theoretical botanists, are aware that grafting succeeds only when the stock and graft are nearly allied; that is to say, when they belong to different varieties of the same species, or different species of the same genus. If, then, such false statements can be made in a work which ought to be a scientific treatise written in verse, adorned only with the imagery of well-known facts or acknowledged fables, how absurd it is to bring forward as evidence the statements of a poet in compositions where his inventive powers are under no restraint, and where his only object is to rouse, astonish, or to melt.

The fabled music of the dying swan is another illustration of the indifference of the ancients to the truth of facts in Nature. This belief held its ground for ages, yet no one thought of testing by a simple experiment the truth of the popular belief.\*

When popular errors, which rested upon no rational foundation, and which, by applying the test of experiment, might at any instant have been disproved, retained their vitality so long, it is not surprising that accounts of extraordinary natural phenomena—exaggerated and embellished as they must have been during their passage from age to age, often by oral

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transmission—should have been accepted without enquiry, and recorded by historians who lived long after the time when they are said to have occurred. But such accounts must be received with suspicion, and cannot be made the basis of a scientific theory, which ought to rest upon facts about which there is no dispute.

The accounts of severe winters at Rome are at intervals of centuries. That of 356 A.U.C., or 396 B.C., recorded by Livy v. 13, and supposed to be the same as that mentioned by Dionysius, and on which so much stress is laid, happened before the taking of the city by the Gauls, when all the records are believed to have perished. It must, therefore, have been handed down by tradition, and in its passage from mouth to mouth it doubtless received many embellishments, until it was finally committed to writing. The winter of A.U.C. 573, or B.C. 179, referred to by Livy, was still 180 years before his time. The winter, also, described by St. Augustine\* as one of extraordinary severity, when the snow lay to a great depth for forty days in the Forum, and the Tiber was frozen over, occurred, if it ever did occur, in the time of the war with Pyrrhus, or 700 years before the age of St. Augustine. St. Augustine concludes his account with the observation: "What would these people have said if such a winter had happened in our times?" Yet this passage is usually quoted in a way to lead the reader to suppose that the winter recorded by St. Augustine occurred during his lifetime, or not very long before.

Such exceptional weather may still recur in the revolution of ages, but it proves nothing with regard to the normal character of a climate. In Tegg's "Chronology" the winter of 1234 is stated to have been so severe in the south of Europe that the Mediterranean was frozen over, by which, I presume, is meant that certain bays and inlets of that sea

\* Quid hyems illa memorabilis tam incredibili immanitate sæviens ut, nivibus horrenda altitudine etiam foro per dies quadraginta manentibus, Tiberis quoque duraretur, si temporibus nostris accidisset, quæ isti et quanta dixissent!—De Civitate Dei. Lib. III. 17.

were covered with ice. Tegg was a mere compiler, and he does not give his authority; but he, probably, knew as much about the winters of 1234 as St. Augustine, who lived at the time of the taking of Rome by the Goths, did of those in the time of Pyrrhus. In 1843 the snow lay for two days on the ground at Rome, and the thermometer of Fahrenheit descended to seventeen degrees, or fifteen degrees below the freezing point; and if we possessed records of all the seasons in Italy for fifteen hundred years,\* we should, probably, find that at long intervals there were some which might vie in severity with those described by Livy and Dionysius, especially if we make an allowance for the probable exaggeration of their accounts.

The only evidence of any value as the foundation of a scientific theory would be the reference of the poets and historians to the weather of their own times. I can recall but few passages of this kind,† of which the two most frequently quoted to prove the severity of the winters in ancient days are the account in the ode of Horace, i. 2, of the weather preceding the great inundation in the reign of Augustus, and the story in Martial of the icicle which fell from the arch of the aqueduct near the Porta Capena, and killed one who happened to be passing beneath it.‡ But

\* The authority of the Abbé de Lonquerue is quoted by Gibbon, in his "Miscellaneous Works," vol. 3, p. 246, for the fact that the Tiber was frozen over in the winter of 1709, which was remarkable for its severity throughout the whole of Europe.

† I take no account of such verses as those which I have already quoted, "Diffugere nives....," &c., for the snows are as unreal as the "Graces," who are represented as dancing after their disappearance.

‡  
Qua vicina pluit ypsanis porta columnis,  
Et madet assiduo lubricus imbre lapis,  
In jugulum pueri, qui roscida templa subibat,  
Decidit hybeino prægravis unda gelu.

Cumque peregisset miseri crudelia fata,  
Tabuit in calido vulnere mucro tener.  
Quid non sæva sibi voluit fortuna licere?

Aut ubi mors non est, si jugulatis aquæ?—IV. 6.



neither of these passages, if examined with the eye of a meteorologist, will be found to sustain this view. Horace, indeed, speaks of great falls of snow, but he also mentions frequent thunder and hail. Now, a frequency of thunder-storms implies a prevalence of scirocco winds, and, consequently, of mild, though wet and stormy, weather. For these storms rarely occur, except during south winds or when the south wind suddenly changes to the west or north, the meeting of the currents in the latter case inducing that rapid precipitation of vapour which is always attended with a development of electricity. We may suppose, therefore, that there were violent thunder-storms with hail, while the wind blew from the south, and that, when the wind changed to the north, the rain became snow, which fell in abundance for a time, and contributed as it melted to swell the inundation, for there is nothing in the ode to shew that it remained even for one day on the ground.

With regard to the story of the icicle, it was certainly unfortunate for the individual who happened to be passing beneath, that it should have detached itself at that particular time; but in the formation of the icicle itself there is nothing extraordinary, for the size which it attained would not depend merely on the intensity of the frost, but on the rate at which the water dripped, which must be such as to supply as much water, and *no more*, as will freeze in a given time. In the present day icicles may be seen hanging from the fountains of Rome after a night of five or six degrees Fahrenheit of frost; and in the winter of 1843, when there were fifteen degrees of cold, the formation of an icicle sufficiently large to kill a man, if it fell upon him from a certain height, may easily be conceived.

But, whatever weight these and two or three similar relations may be thought to carry, the expressive silence of Tacitus and of Pliny the younger, who wrote of events nearer to their time, furnishes negative testimony more conclusive on the other side. Tacitus has usually a chapter in each book devoted to prodigies and natural phenomena of unusual occurrence.

Mention is made in these chapters of a swarm of bees settling on the capitol, of a calf born with its head on its leg, of a great whirlwind in Campania, and of the various inundations of the Tiber; but not a word is said about any winter remarkable for its severity, nor is the occurrence of great falls of snow or intense frost revealed incidentally by the inconvenience they occasioned in the city, or by their effect in impeding military operations.

Again, in the letters of Pliny the younger, which are full of gossip on all subjects, the weather among the rest, there is no mention of frost or snow, though he enters into long details about great falls of rain and the damage which they caused. To this we may add, that the floods of the Tiber are never attributed, by the writers I have mentioned, either wholly or partially to the melting of the snows, but always to excessive rains; though, if such deep snows, as is supposed, had fallen over the whole seven thousand square miles of the basin of the Tiber, their sudden melting must often have been the principal agent in producing those floods. From modern histories the general character of the weather which prevails during a campaign may usually be gathered, and Pliny, as I have observed, is very fond of talking about it. It is strange, therefore, that the subject of frost and snow should never once crop up, either in the history of Tacitus or in the letters of Pliny. It is evident from this that, in the time of Pliny and Tacitus, frost and snow were phenomena of rare occurrence, and mild in their character.

Yet Arnold, in his "History of Rome," assumes as a fact the greater severity of the Italian winters in ancient times, and attempts to explain it by a theory, now exploded, which the progress of the science of heat and the logic of facts in Canada ought to have shewn him to be untenable; the theory, namely, that forests and marshes tend to increase the rigour of the winter cold. "In the time of the Romans," he observes, "the Apennines were covered with forests, and the influence of the forests and marshes of Germany must have been felt as far as central Italy." Arnold was an accomplished scholar,



but he was not a man of science or a shrewd observer of Nature; otherwise, his reason would have told him that forests, as far as they have any influence at all, must tend to moderate the severity of the winter cold, by impeding radiation and preventing the escape of heat from the earth, and observation would have taught him that the soil beneath trees often remains soft and moist, while in more exposed situations the ground is hard with frost. Was he never told by his gardener that on a calm and clear night a piece of canvas placed across four sticks will protect tender plants from two or three degrees of frost, even though the sides are open to the air? From this he might have inferred what would be the effect of trees.

It would be truer to say that the intense cold of certain elevated plateaus was due rather to the absence of trees than the supposed severity of the climate of ancient Italy to their presence; for, in the former case, there is nothing either to retain the heat of the earth or to check the fury of the icy blasts which sweep across its naked surface. The clearing of the forests of Canada has not produced the amelioration of climate which was anticipated, and the cold of the winters is as great as ever. Indeed, the winter of 1865—66 was one of the severest on record, the thermometer at Montreal having descended to twenty-eight degrees of Fahrenheit below zero, while heavy ordnance was conveyed across the St. Lawrence on the ice.

Samuel Forey, also, in his "Treatise on the Climate of the United States" (1842, p. 37), observes that the winters of Salem, Massachusetts, instead of being rendered milder by the eradication of the forests, had been four degrees colder during the last thirty-three years than the preceding average.

There are two passages, however, in the younger and elder Pliny which are thought to support the popular notion of a change of climate in Italy. The younger Pliny, in his letters, describing his villa on the upper Tiber, which must have been, at least, a thousand feet above the level of the sea, observes that, notwithstanding the greater cold of the winters in that elevated region, the bay tree succeeds very well.

"Sometimes," he says, "it is killed by frost, but not oftener than in the neighbourhood of Rome. *Cœlum est hyeme frigidum et gelidum; myrtos, oleas, quæque alia assiduo tepore lætantur, aspernatur et respuit; laurum tamen patitur, et etiam nitidissimum profert; interdum, sed non sæpius quam sub urbe nostra necat.*" In this passage there is something which I find it difficult to reconcile, either with itself or with the evidence to be derived from other quarters. The bay, "*Laurus nobilis*," though somewhat tender and requiring a sheltered situation, is a hardier tree than the myrtle,\* and is very generally planted in English shrubberies, while even the least delicate variety, the broad-leaved or Roman myrtle, requires the protection of a conservative wall. Pliny himself tells us that the myrtle is more tender than the bay,† for he says that the climate

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of his villa rejects the former, but produces very fine specimens of the latter. I have shewn that the myrtle was grown, not only for ornament but for economical purposes, and, of course, in the open air; for the idea of cultivating for their wood trees that require protection is absurd.

If, then, the bay was a hardier shrub than the myrtle, and the myrtle must have survived many winters in the open air, in order to suit the purposes of the cultivator, it is inconceivable that the bay tree could have been killed in the neighbourhood of Rome, except after very long intervals of time, and this supposition is not inconsistent with the language of Pliny, who, by saying that the bay was not killed oftener than at Rome, might intend to imply the extreme infrequency of the occurrence.

The other passage is quoted in Dyer's "Rome" from the elder Pliny, to shew that in his time the snow in the neighbourhood of Rome used to lie a long time on the ground. The words are: "*Alioquin vota arborum frugumque communia sunt, nives diutinas sedere.*" "For the rest, trees and crops have this one wish in common, that snow may lie a long time on the earth."

The strange style of Pliny, who is fond of personifying inanimate objects, and attributing to them the feelings of human beings, often renders a paraphrase necessary in order to make his meaning clear; but I have given, I believe, the sense of the author, who is merely stating the result of observations made, perhaps, at his birthplace, near the lake of Como, where the winters are much colder than in central Italy. Yet, it is absurdly assumed that, because Virgil and Pliny wrote at Rome, they must necessarily have had in their thoughts the climate of Rome when they described the phenomena of winter. If a writer on British agriculture, domiciled at Penzance, were to make the observation in his work that a thick covering of snow was useful in protecting plants from severe frosts, and give directions for the treatment of crops and trees during weather which is not unusual in the wolds of Yorkshire, would it not be preposterous for a foreigner to

infer that heavy snows, lying long on the ground, and severe frosts, were of frequent occurrence in Cornwall. Yet such is the reasoning of Dyer and others, though there is nothing in the passage quoted from Pliny, or in the context, to shew that his words have reference to Rome more than to Mantua,\* Lyons, or Cologne.

The treatise of Virgil on agriculture, and the observations of Pliny on the conditions under which trees and crops are most likely to thrive, are doubtless intended to apply to Italy as a whole, from Tarento, where frost and snow are almost unknown to the valley of the Po, where snow sometimes lies for several days. Why, also, should not the outlying colonies of the Empire, as Lyons and Cologne, be included in the general scope of the work?

But, independently of the evidence for or against a change afforded by the writers of antiquity, it appears to be physically impossible that the climate of any place can have changed since the last geological convulsion which determined the present configuration of the surface of the globe. Geologists, therefore, have been driven to explain the great decrease of temperature which the remains of extinct animals show to have taken place in the northern hemisphere by a different distribution of land and water; by a gradual cooling of the crust of the earth, supposed to have been originally in a molten state, or by a change in the inclination of the axis of the earth to the plane of the ecliptic. But during each geological epoch, the climate of a place can depend only on (1) its latitude, (2) its distance from the sea, (3) its elevation above the level of the sea, and (4) the direction of the prevailing winds. Man, by draining marshes, cutting down forests, and planting trees, may, to a certain extent, and within limited areas, increase the salubrity of the air or modify the amount of moisture which it contains, but the great phenomena of

\* I am surprised that the line "*...teneros defendo a frigore myrtos*" (E. vii. 6), which is supposed to be spoken in the neighbourhood of Mantua, has never been quoted to prove the cold of a Roman winter.

the weather, rain, wind, and snow, depend upon causes which are entirely beyond his control, the four conditions, namely, which I have enumerated.

Any one of these conditions may modify or neutralise the rest. Thus the winters of the eastern states of America are far more rigorous than those of the countries in the same parallel of latitude on the western side of Europe; the difference corresponding to an interval of about ten degrees; so that the winter of a place in latitude forty degrees on the eastern side of America is as cold as that of one in latitude fifty degrees on the western side of Europe.

This anomaly may be explained, partly by the greater extension of land in America towards the North Pole, and partly by the prevalence of westerly winds, which blow right round the globe, in a belt extending from below forty degrees to about fifty degrees of latitude. These winds, if they are either due west, or from points between west and north, after traversing the entire width of the American continent, arrive in the eastern states as freezing blasts, bringing with them frost and snow. Starting again from the eastern coast, and crossing an unfrozen ocean more than three thousand miles in breadth, they reach England and the west of France, shorn of all their severity, and though often cold and raw, yet always some degrees above the freezing point.

The prevalence of these winds appears to me a simpler mode of explaining the difference between the climate of the east of America and the west of Europe than the Gulf stream, which is made to do duty on so many occasions when its services are not required. It accounts, also, for the mildness of the western coast of America as compared with the eastern, the climate of Vancouver's Island resembling that of the British Isles, though it is in the latitude of Labrador, where the winters are intensely severe.

The supposed change in the climate of Italy is not a question of purely speculative interest, but has to a certain extent a practical bearing; for many persons have argued that the greater healthiness of the Campagna in Rome in ancient times

was owing to the severity of the winters, by which the germs of disease were either destroyed or retained for a longer time in a dormant state. If, then, it can be shown that the climate of central Italy has undergone no change within the historic period, the moderns will have no greater difficulty than the ancients to contend with, and may hope, like them, to correct by cultivation or other remedial measures the reputed insalubrity of Rome and the surrounding country.



## CONCLUSION.

Before concluding this work I will recapitulate some of the topics on which I have enlarged. I have treated the Tiber as an object of natural history, and as a monument of antiquity, describing its physical peculiarities, and illustrating from classical authors the feelings of affection, pride, and reverence with which it was regarded by the ancient Romans. I have shown, also, that this feeling of reverence for its divinity, or of superstition as we should call it in the present day, was shared by the Tuscan nations who dwelt along its banks; since they were diverted, Livy tells us, from a war with the Romans, by an inundation which damaged the property of their influential chiefs, and appeared to be of evil omen for the success of their cause.

Our knowledge of the ornamental character imparted to the river must be gathered from the notices, few and far between, which are scattered through the ancient writers. Few travelled in those days but the rich and high born, most of whom had their "hospites" in the principal towns of the Empire, with whom they stayed when they visited a foreign city, and who probably acted as their cicerones in showing them the curiosities of the places. There were, therefore, no guide books, or descriptions of the town and their environs, for the use of the general public, one of which, if it had survived the wreck of time, would have thrown light on a number of interesting points. But the quotations from Pliny and Claudian leave no doubt that the banks of the Tiber for miles above Rome, and probably also below it, were adorned with villas and other ornamental structures, though of the manner in which they were laid out we possess no information. The ancients, doubtless, availed themselves of the

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advantages of the site for picturesque effect, as the moderns might, by planting the ridges and knolls which skirt the strip of alluvial valley through which the river flows.

I am aware that many artists deprecate the idea of planting the Campagna, as impairing its peculiar character; but if the planting were done tastefully and artistically, so as to harmonise with the other features of the landscape, the general effect would be improved, and the banks of the Tiber, lined, as in the time of Claudian, with villas, would present an appearance more pleasing than the banks of the Thames, which wants the fine back-ground of mountains which the valley of the Tiber possesses.

Of the commercial value of the Tiber we possess more precise information, and from many sources. The author of Rome and the Campagna appears to think that, because the Tiber is too narrow for the Warrior to turn in and too shallow to float an East-Indiaman, it could have been of little commercial value, and rejects the description of its advantages put by Livy into the mouth of Camillus as a rhetorical amplification.\* But to say nothing of the accounts of Pliny, Strabo, and others, the passage from Vopiscus which I have quoted seems to shew that it was in those times not only the principal but the only channel in which corn was conveyed to Rome. Aurelian,† in his letter, observes that he had established a line

\* Non sine causa Dii hominesque hunc urbi condendæ locum eligerunt, saluberrimos colles, flumen opportunum, quo ex Mediterraneis locis fruges devehanter, quo maritimi commeatus accipiantur.

If Livy was deceived when he made Camillus enlarge upon the commercial advantages of the Tiber, Cicero must have been under a like delusion when he expressed himself in a similar strain in his "De republica," II. 3-5. The latter calls the river "perennis," which is true; for, unlike the Arno, it flows with a full and strong current even in the heats of summer, and "æquabilis," which is as untrue; for no river varies so much in height, forty feet being the difference between the two extremes. Like Livy, Cicero speaks of the produce of Italy brought down the river, as well as of the commodities imported from abroad.

† I have observed that in the time of Aurelian the Tiber was the principal, and probably the only channel by which Rome was supplied with food. I infer this from the absence of all mention in his letter of Italy as a source of supply.



of merchant vessels between Egypt and Italy, and stationed river-boats "amnicos" in the Tiber in connection with them. The navigation of the Tiber is of less importance in the present day owing to the introduction of railroads and the improvement of the ordinary routes; but as water carriage for heavy goods is cheaper even than by railroads, something will probably be done to render the Tiber navigable from Rome to Perugia. If a canal parallel to the river, in conformity with the advice of Gambarini, is determined upon, there would at least be abundance of water at every season of the year.

With regard to the inundations, I have explained what I conceive to be their causes, and expressed an opinion that nothing but embankments—a remedy worse than the disease—could exclude them from the city, and that no human means can appreciably lower their height. It might be supposed from the remedies which have been proposed that nobody had realised the fact that a channel of given section and declivity can discharge only a given quantity of water, and that, when that quantity is exceeded, it must necessarily overflow. If we are to believe Gambarini and Chiesa, the Nestore, at its junction with the Tiber, is one-third of a Roman mile in width in the time of floods, or broader than the Thames at Westminster bridge when the tide is in. There is, I suspect, some mistake in this; but allowing for exaggeration, the Nestore must after heavy rains bring down an enormous body of water. The Paglia at Acquapendente flows, as I have noticed, in a stony bed, as wide as the Tiber itself at Rome, and must, when flooded, contribute largely to swell the volume of that

The "fruges," and the "res victum cultumque maxime necessariae," which Livy and Cicero (Livy, v, 54, and Cicero de Republica, ii, 3—5) describe as being brought down the Tiber from the interior, had long since ceased to be produced.

At hercule olim ex Italiae regionibus longinquas in provincias commeatus portabant; nec nunc infecunditate laboratur, sed Africam potius et Ægyptum exercemus, navibusque et casibus vita populi Romani commissa est.—Tac. Ann. xii. 43.

These reflections were suggested by a riot in the reign of Claudius consequent upon the dearth of grain, and the high price of bread.

river. When to these, which are but second-rate tributaries, we add the upper Tiber and the larger affluents—the Nera, the Velino, the Salto, and the Turano, which drain the Western slopes of the Apennines for one hundred and forty miles—it appears more surprising that the narrow bed of the Tiber at Rome should be able to contain the immense mass of waters poured into it after every heavy fall of rain than that it should occasionally overflow. How absurd, then, is it to suppose that the removal of a few petty obstructions can have any sensible effect upon the height of the floods.

It may be asked, what I would recommend myself? I reply in the words of the Senate, after taking into consideration the propositions of Arruntius and Ateius, "nihil esse mutandum," "that no change be made,"\* as far at least as the bed of the Tiber is concerned. "A most lame and impotent conclusion" this may appear. But it is better to do nothing than to expend large sums of money on works whose utility is questionable. The first cost of these works, and the expense of maintaining them in an efficient state for thirty, forty, or fifty years, would pay over and over again the damage that the floods might cause in that interval of time. It would be better, therefore, to invest the money and apply it to that purpose than to sink it, not in doing good but in creating a nuisance.

But though the floods cannot be prevented, they may, I contend, be foreseen for twenty-four or thirty hours before they occur, leaving ample time to place all moveable property out of reach of harm. The question, whether the floods of the Tiber are owing to rain or melted snow, may seem to many as vain as the dispute "de lana caprina,"† whether the natural covering of a goat ought to be called hair or wool, and as void of practical result. But a great deal depends on which is the more potent agent, rain or snow, in producing

\* Tac. Ann. i. 79. This does not apply to deepening the river and removing obstructions in order to improve the navigation, or to the construction of quays for ornament and convenience.

† Alter rixatur de lana sæpe caprina.—Hor. Ep. i. 18, 555.

the floods. If, as the Romans absurdly suppose, the rain adds little to the mass of waters, and serves only to promote the more rapid dissolution of the snows, the height of the flood must depend upon the quantity of snow to be melted, of which nothing certain can be known; but, if the rain be the principal agent, its depth may be measured, not only at Rome, but at other stations within the basin of the Tiber, and the average taken. If this be multiplied by the area of the basin, we have, making allowance for the portion which disappears by evaporation and percolation, the cubical content of the mass of water which would find its way into the river.

In this way, on Tuesday morning the twenty-seventh of December, 1870, I made a calculation of the quantity of water produced by the rain of Monday night the twenty-sixth, namely, 1.6 inch, and found that, if it extended over the whole basin of the Tiber, it would be more than sufficient to fill a reservoir twenty miles long, two miles broad, and twenty feet deep, or forty miles long, two miles broad, and ten feet deep.\* The river was at that time two feet deep in the Ripetta. Such a quantity of water therefore, coming at a time when the Tiber was already flooded, and its channel could contain no more, was quite sufficient to account for the inundation. Yet the foolish Romans could not be persuaded that the rain of Monday, violent as it was, would have any effect upon the river. Grounding my opinion on the calculation I had made, on the Tuesday morning I confidently predicted a great flood into the Corso on the Wednesday following, but could not succeed in convincing the tradesmen, who, if they had placed a watchman at the Ripetta on Tuesday

\* Vallès tells us that of a given quantity of rain four-sevenths were discharged by the Po, and only two-sevenths by the Seine, owing to the absorbent nature of the soil through which many of its tributaries flow. Three-sevenths appears a large quantity to be lost by percolation and evaporation in the case of the Po. A good deal depends upon the state of the ground with respect to saturation and upon the time within which the rain falls. On the night in question the greater part of the one inch and six-tenths of rain fell in two or three hours, and the earth was completely saturated, so that comparatively little of it was lost.

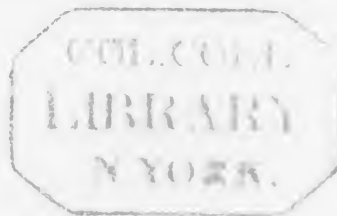
night to give the alarm, would have received information of the rapid rise of the river, which took place at two or three o'clock on Wednesday morning, and have had time to save a large portion of their goods.

I would recommend, therefore, that there should be meteorological stations in the principal towns at the entrance of the basins of the tributaries of the Tiber, namely, Orvieto, Perugia, Foligno, and Terni. It has been suggested that the height of the flood at Terni and other places should be telegraphed to Rome. I would take time by the forelock, and telegraph to Rome the depth of rain at all these towns; thus enabling a calculation to be made, on which might be based a sound conjecture as to the height of the coming flood. The height of the river at the time must, of course, be taken into consideration; for the same quantity of rain which would produce a great and disastrous inundation, when the river is full, might only be sufficient to fill it to the brim when low.

I now conclude, hoping that what I have said about the Tiber may divert to it some portion of the interest which is now concentrated upon brick and mortar, and that my observations upon the causes of its inundations may, on the one hand, save expenditure on useless and injurious plans, and on the other, suggest precautions which, if they cannot lower the level of the floods, may at least reduce their injurious consequences to a minimum.

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